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THE PRACTICAL TEACHER

DR. FRIDTJOF NANSEN.

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·VOL· XVII No. 9

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NOTES OF A LESSON ON ROOTS AND TUBERS.

BY PROFESSOR J. R. GREEN, SC.D., F.R.S.,

Examiner in Botany to the University of London, Late Examiner in Botany to the University of Cambridge.

SEE SUPPLEMENT PRESENTED WITH THIS NUMBER.

SPECIMENS REQUIRED.

SOME of the specimens required for this lesson may easily be obtained. Such are a Carrot (Fig. 1), a Radish (Fig. 2), a Turnip (Fig. 3), the root of any kind of Grass (Fig. 4). These the children should be encouraged to bring. The root of the Spiræa (Fig. 5), and the root of the Dahlia (Fig. 7), may probably be had from a nurseryman. The children will also be interested in growing mustard and cress to show the filiform root in Fig. 6, in sowing seeds of the broad bean in pots and in water, and in comparing a winter potato tuber (Fig. 10) with the illustration of a new potato dug from the ground. if a new potato plant cannot be obtained in a forced condition. The root of the Early Purple Orchis (Fig. 9) may be found in woods and pastures. Its mottled purple flowers will not be seen then before the end of May, or beginning of June, but the oblong leaves clasping the stem and stained with dark purple spots may serve to identify the plant. The root of the Spotted Orchis (Fig. 8) can be met with on heaths and commons. Its leaves are spotted like those of the Early Purple Orchis.

OUTLINE OF LESSON.

I. *What is a Root?*—Let us take the very young plant obtained by sowing the seeds of the broad bean in a pot. We shall see quite clearly that there is a part of the seed—viz., the *radicle*—which in whatever position the seed is sown eventually works vertically downwards. This part is called the *Root*. Now if we take a seed of the broad bean that is just beginning to grow, wash it free from the soil, and fasten it by means of a pin to the underside of the cork of a wide-mouthed bottle, filled with water nearly to the point of the young root, and make an aperture in the cork, we shall find that the root grows down into the water, and branches, while the shoot develops in an upright direction. Now, comparing our roots with the stems we formerly observed, we shall see that they differ (1) in direction, the root growing vertically downwards, the stem upwards; (2) in colour, the root being without green colouring matter, while the stem contains green colouring matter, unless blanched, or otherwise kept from the light ; (3) in the presence of leaf buds, which are not borne by the root, a characteristic generally sufficient to distinguish roots from underground stems ; (4) in the ending of the root in a conical point, or root-cap, which can be seen if we hold up our bean root to the light and examine it with a magnifying glass.

II. *Primary, Secondary, and Adventitious Roots.*—Let us look again at our young bean plant in the bottle. The radicle has developed downwards into a root, the *primary root* from which have developed in a fixed order numerous *secondary* roots. Their order of origin is this : each new root has arisen nearer to the apex than the one preceding it. Some roots do not develop in this fixed order, but arise out of their proper succession. They are called *adventitious* roots. Good examples are found in the roots produced on ivy stems by which they are fastened to a wall, or fence, and also in the roots which arise when a cutting of a geranium is taken. When the cut end of a young twig of geranium is placed in moist, sandy soil, it soon develops adventitious roots from its surface.

III. *The Forms of Roots.*—Let us look at our mustard and cress (Fig. 6). They have simple primary thread-like roots. Such roots are called *filiform* or thread-like. If we look again at the young bean plant in the bottle, we shall see that the primary root is thicker than its branches. Such a primary root is called a *tap root*. We will now compare it with our Carrot (Fig. 1). In shape it is *conical*, being broad at the base and tapering towards the apex. The roots of the Monkshood and Parsnip are also examples of conical tap roots. The root of the Radish (Fig. 2) swells out a little below its base and then tapers upwards and downwards. Such a root is called *fusiform* or spindle-shaped. Another example is found in the Beet. The root of the Turnip (Fig. 3) is much swollen at its base, becoming globular, and tapers below into a long point. Such a root is called *napiform*. Another example is to be found in a variety of the Radish, which is therefore called the Turnip Radish.

Very often there is no permanent primary or tap root, and we have other forms caused by the secondary roots becoming modified. In the root of the Grass (Fig. 4), the root divides at once into a number of slender branches or rootlets, and is called *fibrous*. Many annuals have this kind of root. In the Spiræa (Fig. 5) the branches of the root are enlarged irregularly towards the end. Such a root is called *nodulose*. Another example may be found in the Common Dropwort. The Dahlia (Fig. 7), and the Early Purple Orchis

(Fig. 8), and the Spotted Orchis (Fig. 9), are interesting examples of what are called *tubercular* roots. In them the divisions of the root have become enlarged so as to form more or less oval expansions. These enlargements are called *tubercules*, and the root is said to be *tubercular*. In the Dahlia, where a number of tubercules arise from a common point, the root is said to be *fasciculate* or tufted. In the Early Purple Orchis (*Orchis maculata*) the tubercules are divided at their extremities so as to resemble the human hand. They are therefore called *palmate*. In the Spotted Orchis they are nearly round or *globose*.

IV. *How Tubercular Roots differ from Tubers.*—The *tubercules* of tubercular roots must be carefully distinguished from *tubers* which are modifications of the stem. Let us look at the Potato (Fig. 10). This is a true tuber. There a subterranean stem or branch has become very much enlarged by the deposit of starch in its tissue, and on its surface are a number of little buds, or eyes. That the potato is stem-like may be seen by experiment. Cut one into pieces, each piece containing one or more buds, and plant them. The buds, nourished at first by the stored-up matter that surrounds them, put forth roots and become independent plants.

V. *The Duration of Plants.*—There is a difference in the length of time roots live. Annuals, *e.g.* Grasses (Fig. 4), grow from seed, flower and die in the course of the same year in which they are developed. The roots of annual grasses all spring from a common point. In some other annuals, *e.g.* the Sweet Pea, the primary root is small and gives off from its side a number of small branches.

Biennial plants, *e.g.* the Carrot and Turnip (Figs. 1 and 3), spring from seed one year, but do not flower and ripen their seed till the second year, then they perish.

Perennial roots, *e.g.* the Dahlia and Orchis (Figs. 7, 8, 9) and the Wallflower, are the roots of plants which live for many years. Fleshy roots, like those of the Dahlia and Orchis, are as a whole perennial, but any particular portion of them may perish. Annually some portions of them die, but before they do so other roots are produced from some other portions of the substance of the root. Woody roots, like those of the Wallflower, last in their entirety many years.

VI. *The Root as an Organ of Attachment and Support.*—Roots are organs of attachment and support. Subterranean roots, comprising all those we have been considering in this lesson, push their ends into soil with great energy, and their branching tends to keep the plant firm in the soil. The delicate hairs with which the youngest roots and rootlets are furnished near their apices make their way into the interstices of the soil, and play a very important part in anchoring the plant to the substratum. Where root fibres have closely applied themselves to the soil by means of root hairs, the power of shortening possessed by roots will draw a vertical tap root tight by means of its side rootlets, as cordage strains and makes a ship's mast tight.

Aerial roots, like those of the Ivy, may serve to fasten the plant to walls, fences, or other foreign substances.

Parasitic roots, like those of the Mistletoe, fasten the plant to the living tissue of the oak or other host plant.

Supporting roots are found in the Tropics. They may be *tubular*, as in the Indiarubber Fig, where they spring from the lower part of an erect trunk and look like tablets placed on end. They may be stilt-like, as in the Screw Pine, when, arising from the erect or oblique trunk, they are cylindrical and have the appearance of oblique props. They may be columnar, as in the Banyan Tree, when they originate from the horizontal or obliquely ascending branches of trees and grow vertically downwards.

VII. *The Root as a Means of Absorption of Food.*—We have seen that the end of the root is covered by a root-cap. This root-cap protects the root while it is forcing its way into the soil. The cells comprising it wear away, and are continually renewed. If we pull a plant out of the earth, especially a plant with fibrous roots, we shall find a number of particles of soil adhering to the delicate root hairs while the growing end of the root is quite smooth and clean, and the particles of earth also fall off from that part of the root lying behind the hairs, because the hairs have there died off and disappeared. If the first branches of the Bean Root growing in water are carefully examined, numbers of these hairs will be seen forming a close tuft not far from the apex. They only last a little while, and are consequently only to be seen in the very young branches. They may be seen, too, on the *filiform* roots of mustard and cress. Now, cultivated soil consists of inorganic matter derived from the breaking down of roots and organic matter formed by decaying vegetable substances. Between the particles of which soil is composed there are interstices usually filled with air, but capable of containing varying quantities of water. When these interstices are filled with water, the plant cannot readily absorb the water necessary for its support. When air is present in them, each particle of soil is surrounded by a delicate film of water, and the plant can only make use of this water. The delicate root hairs, which we have seen adhere closely to the particles of soil, contain a certain amount of acid which has a great power of attracting water into the cell, so that the hair becomes turgid. As all the hairs of the root unite in taking up water in this way, a great quantity is absorbed from the soil. This is attracted in a similar way from the hairs into the outer layers of the substance of the wood, which thus becomes very *turgid*, or full of water. The elasticity of the walls of all the cells of these layers exerts a great pressure on the contained water, and forces it into the wood vessels which are in the centre of the root. This is often called *root pressure*. It is one of the causes of the flow of water from the roots to the leaves. The water absorbed from the soil contains certain mineral substances in solution which are nutritive to the plant.

VIII. *The Root as a Storehouse of Reserve Materials.*—We have seen that some plants only live a year (annuals) and that others live for two (biennials) or several years (perennials). When the root is not woody it is often thickened, wholly or in part, as we have seen in the case of the Carrot (Fig. 1), Radish (Fig. 2), Turnip (Fig. 3), Dahlia (Fig. 7), Orchis (Figs. 8 and 9). The thickened part may then be regarded as a storehouse of starch and other food materials stored up for the use of future shoot buds. We have seen that the Carrot during the first year of its life does not flower, but only bears leaves. It is thus enabled to manufacture a large quantity of nourishment, which is deposited in the root and remains there all winter. In the spring fresh leaves are formed, but the stem also bears flowers and fruit, in the formation of which the nourishment of the preceding year is consumed. After the formation of the fruit and seeds the plant dies. Some perennial herbs, *e.g.* the Dahlia, show a similar proceeding year after year, dying down every winter, the fleshy roots being the only parts remaining alive.

IX. *The Sensitiveness of the Root.*—The growth of a root is determined by its sensitiveness. We have seen that in whatever position our beans are sown, the young roots bend and grow vertically downwards. This tendency is due to the stimulus of gravity.

WELL-KNOWN TEACHERS AT WORK.

No. LIII.—JAMES BREBNER, M.A. (EDIN.), F.E.I.S.

Fellow of the Botanic Society of Edinburgh.
Rector of the Harris Academy, Dundee.

THE Harris Academy owes its origin to that private and princely munificence for which Dundee is famed. Bailie Harris contributed £1,000 on condition that Higher Education should be given as well as Elementary. The Academy was opened by Sir Lyon (now Lord) Playfair in 1885. It was the

FIRST SCHOOL OF ITS KIND

established in the North-east of Scotland. The uniform success which has characterised it as a school for placing superior educational advantages within the reach of all at a moderate fee, is mainly due to the judicious pilotage of its able and accomplished Rector. Mr. Brebner is no mere ornamental figure-head. The breadth of his intellectual sympathy, his normal college and university training, and his personal knowledge of the wide range of subjects taught, enable him to secure remarkably high results. In living touch with subject and teacher he secures 'the solidarity of the whole system of education pursued.' The curriculum reflects the course of study pursued by such prominent teachers as Mr. Milligan, Garnethill, Glasgow, and Mr. Scotson, of the Higher Grade School, Manchester. In forming schemes of study, Mr. Brebner proceeds cautiously, tentatively, and after full examination of what is done by teachers in the front rank of the profession. The functions of the institution are practically unlimited. In the

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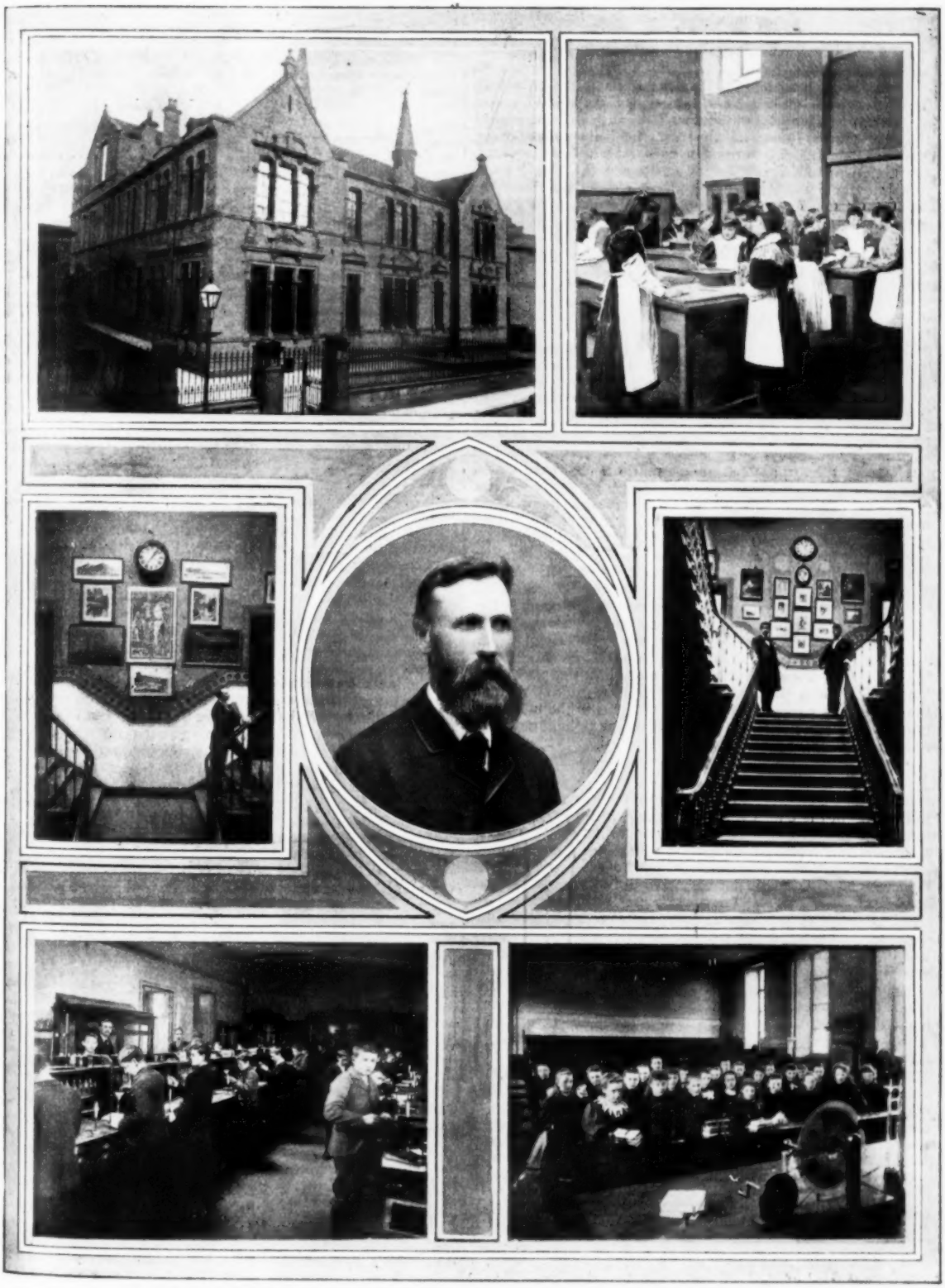

VIEWS OF THE HARRIS ACADEMY, DUNDEE—RECTOR: J. BREBNER, M.A.

first-class training in handicraft, cookery, industrial work, and athletics (including swimming). Measured by the recognised tests, the education may be safely characterised as sound, liberal, and ideal. Last report furnishes the following results:—'78 pupils have gained the Merit Certificate; 52 Higher Grade Leaving Certificates and 180 Lower Grade Certificates' were gained. The Honours Grade we find is also represented. The list of Honours gained during Session 1894-95 showed that in the Scotch Universities (Arts, Medicine, and L.L.A.), in the Science and Art Examinations, South Kensington, Civil Service, and several national competitions, the Harris Academy occupies a front place. With an attendance of 1,000, and such a wide field of work, we could not do more than walk through the classes. In

The Workshop

we saw the senior boys engaged in sawing, planing, and in making joints, simple and double mortise, etc., while a few were constructing useful articles and mechanical models to illustrate the teaching of machine and building construction. The excellence and practical nature of the work impressed us. The course of study is systematically arranged, and develops the hand and eye training which is begun in the Kindergarten. The pupils handle the tools in use in the ordinary workshops of this country. They study the nature and properties of the materials used. Several finished articles were put before us, such as tool-boxes, bookcases, tables, and last, but not least, a most substantial wheelbarrow, which would have done credit to any of our best tradesmen. Mr. Gray, who has charge of this department, has a clear conception of what is meant by manual training and of its relations to the school work. Drawing and construction go together in his classes as two parts of one whole—in a word, ideas are expressed through drawing and construction. In listening to the intelligent manner in which some young boys threaded their way through difficult practical geometry problems in the mathematical room, we had proof positive that the workshop, as Mr. Brebner has it, is a decided gain to a school as an educational factor—an indispensable essential, we should say, to the best success in drawing, machine construction, higher mathematics, and mechanics. Mr. Brebner holds 'that all the males of a nation which sends her sons to the uttermost parts of the earth should know how to use axe, hammer, saw, and screwdriver.'

Kindergarten Work

serves as a substantial introduction to workshop operations in the case of the pupils who *begin* their education here. A glance at the occupations is sufficient to prove that Miss Morrison is a specialist in Froebel's system. Her furniture and equipments are up to date, and her museum and shelves teem with neat and original samples of work. In the early days of the Academy, Mr. Brebner introduced Kindergarten work on an extensive scale. In these days 'Gifts' and 'Occupations' were not understood by parents nor by directors. Funds had to be manufactured in the Kindergarten. The material was supplied to the children, and the articles made were *sold* at the end of the session. It was soon acknowledged that this handicraft awakened a lively interest in school, and invested the ordinary subjects with new life, while it redeemed some with strong mechanical aptitudes, but 'slow in the uptak' of routine work, from the stigma of being blockheads. The School Board sanctions this subject now, and allows a fair amount of material for the use of the classes. The healthy condition of the workshop and Kindergarten departments is doubtless largely due to the efficiency of the presiding teachers, but the activity, vigilance, and enterprise of the Rector were stamped on the organisation, forms, and processes—and very specially in dovetailing the work of both departments into the general school studies, so as to produce 'the cultured mind, the skilful hand.' We give a copy of the Inspector's last Report:—

Infant School.

Inspector's Report for last year.

'The Infant School is conducted in a very successful and efficient manner. Excellent order is maintained, and a pleasant cheerfulness is everywhere apparent. Reading, Spelling, Intelligence, and Slate-writing are all of superior quality. A great quantity of excellent Kindergarten and Needlework was shown, and the exercises in these were also extremely well done, as were also the Singing, Recitations, and Drill. Arithmetic is well advanced. Object and Conversation Lessons, well suited to develop the intelligence, are given daily.'

Science.

Mr. Brebner was the first to introduce Elementary Science as a class subject in Dundee. In glancing over his schemes, past and present, we could not help feeling that with an elastic code he could do work that would tell on the school in a most pronounced manner. The older schemes, rich in scope and in results, had to be cut down, however, in accordance with the new regulations of Code 1895 and its 1*s.* grant. Mr. Brebner is not disposed to give up science, however. He looks on it as all along a most successful innovation. 'It quickens,' he says, 'the intelligence of the boys, trains them to observe and reflect, and makes the outward world more interesting to them.'

As a preparatory training for the scientific studies of the pupils in the Secondary department, where Chemistry and Physics are the principal subjects taken up by the boys, and Physiography and Physiology by the girls, this class subject is handled admirably. All the lessons in all the standards are specially adapted to 'cultivate habits of exact observation, statement, and reasoning.' In the higher classes the method adopted in teaching Physics and Chemistry is that known as the

Laboratory Method.

The aim of the teaching is not only to exercise the mental faculties, but also to 'import to the pupils a training which will be of a directly useful character after they have left school to engage in practical work.' Chemistry (Theoretical and Practical), Physics, and Principles of Agriculture are taught on the most approved lines. The chemical laboratory has had one effect not contemplated when it was opened. 'It has filled nearly all the chemists' shops in Dundee with Harris boys.'

The laboratory and the workshop have had in the past history of this great school a most beneficent effect on the minds of the pupils through hand and eye training. But in addition, both have done good service in enabling boys to find out what work in life was likely to be congenial, and thus guiding them in the choice of a career or trade. Parents and guardians acknowledge that the workshop has 'enabled fathers to find out whether their boys were likely to turn out good handicraftsmen.'

The crowded appearance of the laboratory benches on the day of our visit, and the lively interest awakened by the lesson on 'Electricity in the Service of Man,' proved that Science in the 'Harris' is a world full of thought and valuable experience, a department of study fraught with wide uses and 'a generous human interest.'

Cooking at the Harris Academy.

The Cookery Classes, under Miss Ewan, meet the demand for the training of girls in order that in future we shall have better wives, better mothers, and better servants. It is not the number of dishes cooked nor the recipes recorded in the note-books of the girls which contribute the valuable part of the training, but the 'systematic way in which the pupils are made to carry out the preparation of dishes, the lessons in the necessity for cleanliness in hands and utensils, and practice in neat-handedness and despatch.'

Science and Art Department.

We were interested in the Science reports, and to our question on the Standard of Examination, Mr. Brebner replied, 'The raising of the standard of examination by the Science and Art Department has done harm to us and to Education. By cutting off the Second Class Certificates they have deterred many from beginning the study of science, and cut off the feeders of the Advanced Stages in our University College and Technical Institute.'

Mr. Brebner argues that 'so far as possible every subject should be taught at school. The elements are better taught by one who is a trained teacher than by a distinguished man of science in a university.' We heartily endorse Mr. Brebner's views on these points.

The Leaving Certificate.

Examinations press hard on the Harris Academy 'because the pupils are younger than in the secondary schools, and they do not stay so long with us.' The proposal to group subjects is not favoured by Mr. Brebner.

'Many of our girls would break down in the attempt to gain, say, four or five Leaving Certificates. The present system allows them to give most of their strength to two or three subjects during one session, and take up the others more vigorously the following year.'

Mr. Brebner asks, 'Why should the plan adopted by all hardworking university students not to be equally good for senior scholars? The Higher Grade Leaving Certificate is as much an instance of specialising as the Departmental Certificates of an M.A.'

Home Lessons.

The Rector of the Harris Academy has a very strong opinion of the value of Home Lessons. He regrets to see that 'many parents are so selfish and indifferent to their children's best interests as to raise objections to the practice.'

Mr. Brebner affirmed that 'no boy ever rose to eminence in any path of life where thinking and culture were indispensable to success who did not spend his evenings in earnest study.' He very pointedly condemns the wasting of precious time in school committing poetry or facts in Geography and History to memory when they could be equally well done at home.

In further support of this homework he points out that 'the children would while engaged with it be kept from the streets where so much mischief is learned.'

When pressed as to the nature of the home lessons that can safely be prescribed, Mr. Brebner frankly admitted that 'no teacher has a right to throw a new and difficult subject at his class and ask them to wrestle with it without any counsel as to how it is to be tackled.'

All the teachers under Mr. Brebner carefully clear away the difficulties connected with homework, and give hints as to the best methods of preparation. 'The object of home lessons in this school is to form habits of patience, self-reliance, exactness, and reflection, as well as to impress more vividly on the mind the lessons taught in school.'

As to the senior pupils, we were glad to learn that the home lesson difficulty 'vanished.'

'They have generally formed student habits, and merely need kindly interest and supervision by parents or teachers.'

The Rector pointed out that

The Defect of Modern Teaching

is 'that too much is done for the pupils.' 'Knowledge is poured into them all the day,' and Mr. Brebner thinks they are in danger of ceasing to be actively apprehensive, and when asked to reproduce what has been taught the teacher is generally grievously disappointed. 'In the old parochial schools there was too much silent working: in our modern schools there is too little.' Mr. Brebner is of the opinion 'that occasionally a class should be asked to tackle sums and problems in their own strength,' and this with the view of bringing out originality and power of resource.

The High General Level of Excellence

in all the departments is abundantly attested by reports, results, grants and honours gained.

Drawbacks

exist, and the Rector pointed them out—frankly. In the first place the school is greatly handicapped by having to prepare for the Inspector, and also for Leaving Certificate Examination. The same kind of preparation does not secure success in both, since these examinations, as everyone knows, proceed on different lines. We were surprised to see results so high in the circumstances. Some compromise surely could be made. We should say the pupils are over-examined, not to speak of the strain on the staff. The large influx of badly prepared pupils is a most damaging element. Again, there is evidently an insufficiency of playground. This makes good discipline very difficult. The pupils cannot all be in the playground at the same time. Supervision becomes very arduous in an institution which is practically 'scattered over a wide area,' and no speaking tubes to put the Rector into communication with the various class-rooms. The Inspector himself recognises the scanty playground, and speaks of the Rector's room as a 'band box.' Too many of the class-rooms even deserve the epithet—'It is most remarkable to find such a prosperous school denied elbow-room for its palpitating energies.'

In our rapid survey of the school we must omit much that would interest our readers. We spent some time in the

Higher English and French Classes,

and we are at one with the Inspector as to the 'scholarly and enthusiastic teachers,' and 'the interesting class of pupils.' The English class was handled by one who understood thoroughly the true province of the English teacher. The intelligent answers proved that he has the power of indoctrinating his class, as a whole, into the style and thought of our classic writers. It was gratifying to find that the defects of the author read were carefully noted, as well as his merits. While the lesson dealt with the usual discussions of antiquated grammar, idiom and vocabulary, of which too much is made by examiners, valuable hints were thrown out to assist the self-culture of the pupils and to aid them in mastering the living English tongue.

In French, we admired the methods of the teacher. The class had a lesson on Composition. We could not wish for a better test of method and results. The principles of composition were set forth in systematic array, as Professor Bain of Aberdeen would say, and the pupils were encouraged to exert their capabilities in the expression of thought in the foreign tongue. Led by the variety of forms into a wide range of points of style, the teacher displayed great skill in handling the objectionable and in emphasing the appropriate. The discipline in these classes was perfect, and the refinement and high-toned atmosphere which prevailed would put many of our more aristocratic seminaries to the blush.

Our space is exhausted, and we can only set a

Summary of Interesting Subjects

entered in our note-book for comment before our readers. The wealth of resource in Mr. Brebner for ministering to the taste and refinement of the school will impress any visitor. Every available space is filled up with crest or picture, model or specimen. Cyclostyled notes of Lessons on Botany put the subject very effectively before senior students. Recitations are carefully selected by him and printed in neat volumes for the respective standards. An interesting school magazine affords scope for 'the first rushes of the coming waves of emotion,' and is conducted on the lines of the well-known *Dundee Institution Annual*, another of Mr. Brebner's organs of inspiration. We have some half-dozen University Magazines before us, and in all honesty we can say that the talent displayed in the *Harris and Dundee Institution Magazine* is on a level with the best of these. Religious instruction is given according to a syllabus approved by the Dundee School Board. There is a luncheon room connected with the Academy, for the use of the pupils. In the commercial department, Phonography and Bookkeeping are taught so as to qualify for the counting house or reporters' table. Under its able Rector this school educates, cultivates, and prepares the children of the middle class for the various vocations of life, without waste of time, money, or labour. In every department the teaching is practical, thorough, and modern. Most assuredly it deserves the support of the community, and no time should be lost in sweeping off all hindrances to its success. The courtesy of the Rector and his staff made our visit most enjoyable and instructive. The school is one of the richest in refining and formative influences that we have ever visited.

MR. BALFOUR'S EDUCATION BILL.

'Hope deferred maketh the heart sick; but when the desire cometh, it is as a tree of life.'

WITH the introduction of the new Education Minister's new Bill the Great Polemic enters upon another stage, not, alas! by any means the last, for the fondest imagining of the most enthusiastic supporter of the proposals that are backed by Mr. Balfour, Mr. Chancellor of the Exchequer, Sir John Gorst, and Mr. Solicitor-General cannot see finality written between the lines of the latest legislative attempt to benefit education. And, however much we may deplore the evil hour in which popular education became the spoil of contending political factions, we must, perforce, regard it as more tolerable to endure political strife and rancour, yet a little while, than to accept as final a Bill whose clauses—

> 'Palter with us in a double sense;
> That keep the word of promise to the ear,
> And break it to the hope.'

which is exactly what Mr. Balfour's Bill is calculated to do, at least as regards the best voluntary schools, as regards the rural voluntary schools, and as regards the necessitous Board School.

Superficially the Bill is simplicity itself. A grant-in-aid of five shillings per head on the average attendance may be given to necessitous non-Board Schools; such schools are to be exempt from rates, and no longer is the amount of Government grant earned by them to be controlled by the seventeen-and-sixpenny limit.

It is well known that the PRACTICAL TEACHER accepts no party and favours no partisan. Our concern is with our namesakes. Their weal is our care, whether their 'daily round and common task' be performed in shady sylvan solitudes or amidst noisy urban nastiness. We therefore begin by drawing attention to the absence—the sinister absence—of any guarantee that the prime sufferers under the present system shall be prime *bénéficiaires* under the Bill. Too long has the voluntary teacher realised from hard experience 'How bitter a thing it is to look into happiness through another man's eyes,' for him to willingly enter upon that undesirable state—

> 'Since called the Paradise of Fools, to few unknown.'

No, the education question is down for partial settlement, and partially settled it will be, for good or for ill. Wherefore it is for the teacher to take to heart the words of Butler—

> And look before you ere you leap,
> For as you sow you're like to reap.

And there is enough of the ominous about federation to make it undesirable to leap too quickly into that. For what does federation mean but the pooling of the grant in aid and the doling of it out to schools that are necessitous from the point of view of the organising master, whose salary, as well as that of the other items of the dispensing machinery sure to be set up, will be no inconsiderable tax upon the already grossly inadequate aid. Consider the case of that type of school whose successful management has been the main factor in preserving public faith in the voluntary system. The managers, by dint of hard work and unflagging energy, have got in a goodly array of subscriptions. They have paid their teachers a living wage, and all, working together, have been rewarded by something bordering on prosperity. Such voluntary schools, to the everlasting credit of the untiring managers and teachers, are not uncommon. The grant-in-aid would enable them to realise more nearly their ideal of efficiency. Under the Bill they must federate or lose their aid. If they federate, they will be regarded as non-necessitous, and again they lose the aid promised by Mr. Balfour's bantling. This is no fancy sketch. It represents the disheartening expectation of two of the best voluntary schools known to the writer, one of which is in London, the other in a London suburb.

To the rurals the prospect is even blacker, for, with a cynical disregard of all that has lately been proved regarding the 'parlous state' of rural schools, the Bill actually proposes that the amount payable to such schools shall be at a lower rate than obtains in urban districts. Wherefore the federation part of the Bill must be opposed vigorously, and its place should be taken by a clause setting down categorically that the aid is to be expended in making education more efficient, especially with regard to the teaching staff.

Then as to the abolition of the seventeen-and-sixpenny limit, accompanied, as it will be, by the permission to take three or even four class subjects. Look on the following picture and judge if it is overdrawn: 'On the recommendation of Mr. Linxi, the organising master, there has been allocated to us a capitation grant of four shillings per head, which, on your average attendance of one hundred and twenty-five, Mr. Hardwork, amounts to £25. But Squire Ownall has intimated that the depressed state of agriculture will no longer permit him to subscribe to the school-funds, and his example has been followed in this respect by Farmers Sow and Reap, his tenants; what, therefore, we gain in grant we lose in subscriptions. In order to avoid a decrease in your salary, the managers recommend you to take two other class-subjects, and a specific subject for your elder scholars.' In vain does Mr. Hardwork protest that his staff is insufficient and inefficient for such extra work, that the children will be crammed to their mental detriment; Mr. Linxi has said that it is done elsewhere with very encouraging financial results, and, not too delicately, has hinted that, if Mr. Hardwork will not do the extra work, a Mr. Harderwork can be found to take his most desirable post! Mr. Balfour, Mr. Chancellor of the Exchequer, Sir John Gorst, and Mr. Solicitor-General may hold up their hands in horror at such a picture, but it is none the less true to life, and more than likely to be realised, unless something more definite be put into the Bill to ensure that it does not blossom into a Bill to relieve subscribers. Nay, even Sir John Gorst himself, one of the sponsors of the Bill, specifically states that without 'effective precautions it' (the grant) 'would be swallowed up in relieving subscribers, and there would be nothing left for managers to spend upon the schools.' 'Due regard being had to the maintenance of voluntary subscriptions' is the happy-go-lucky phrase intended to safeguard the aid; but when it is remembered that nearly two thousand so-called voluntary schools have no subscriptions whatsoever, that seven hundred other schools subscribe less than one shilling per head, it will be seen how very binding such a pious opinion is likely to be upon many of those who are supposed to be intent upon the preservation of the voluntary school. Consider that Mr. Hardwork at college sat cheek by jowl with Mr. Mainchance, that he was a better scholar and a better teacher than this more fortunate brother, who receives some £200 per annum more than his former college chum, and then you will realise that it is the teacher who makes the sacrifice whereby the voluntary system becomes possible, and will understand how necessary it is to earmark this new grant for the benefit of the Hardworks, whose compulsory self-denial in support of the voluntary school is on a tremendously higher scale than that of the Archbishop of Canterbury.

And then the audit. There is nothing in the Bill to show that this will differ in any way from the practice which at present obtains—that is to say, the inspector, amongst other parts, will play that of amateur accountant. What can be expected from such an examination of accounts by such an examiner, compelled, as he necessarily is, to go through the whole of the items of receipt and expenditure in the space of a few minutes? If there is anything to discover, it is midsummer madness to ask H.M. Inspector to ferret out the malversation as things go now. That there is something to lay bare is patent from the published evidence of voluntary teachers themselves, without one single word from those outside the pale of the voluntary

school. And is it not to the advantage of the teacher that the appropriation of school funds for other than school purposes should be made impossible? Surely yes, seeing that if his salary does not pay the piper, certainly his apparatus and materials do. As no firm reason can be rendered why the audit should not be a professional one by a chartered accountant, something more drastic should be inserted in the Bill to accomplish this admittedly desirable end.

Thus far we have endeavoured to show that, regarded as an instalment of justice, the Bill falls far short, not only of perfection, but even of sweet reasonableness, and we urge upon our readers to bring these points before their Parliamentary representatives to the end that the amendments, which certainly will be brought forward, may be successfully carried. Let each one of us take to heart the advice of Milton:

> 'Then let me not let pass
> Occasion, which now smiles,'

remembering that when once the Bill becomes law, to amend it will be infinitely more difficult of accomplishment than it is to-day. A five-shilling grant with no compulsory federation, with effectual safeguards for keeping up subscriptions, and with a real, reliable audit, together with an earmarking clause, will be at least an instalment of relief. These safeguarding clauses being omitted, it requires no prophetic instinct to see that the result of Mr. Balfour's attempts at amelioration will be to many schools—probably to most—about as satisfying as Dead Sea fruit.

From the standpoint of the School Boards the Bill is sheer mortification, but slightly lessened, be it remarked, by Mr. Balfour's ambiguous promise of a measure of relief to be introduced at some fit time after the enactment of his present Bill.

It is satisfactory to note that some of the fallacies upon which the abuse of the Board School system has been founded are being shown up. It is now admitted that the requirements of the Education Department, and not the rivalry of the Board School, are to be credited with the increasing cost of education, the burden of which has fallen upon School Boards as well as upon voluntary managers. Furthermore, in districts of abnormal growth in population—such as West Ham, Tottenham, and Walthamstow—no voluntary system could possibly have catered for the educational wants of the community. Here a School Board and an exceptionally high School Board Rate are inevitable, and here the need for relief on account of the comparative poverty of the district is self-evident, and it is difficult to see why such districts should be expected to possess their souls in patience on the mere assurance that something may be done for them later on. Walthamstow has given no uncertain intimation as to what amount of support Mr. Balfour may expect to get from necessitous School Board areas, and, strong as the Government is, it dare not fly in the face of such an unequivocal expression of opinion.

Again, the average attendance in Lancashire and in London is pretty much the same; but, whereas Lancashire would get £112,000 under the Bill, the share of London would be but £42,500, *i.e.* little more than a third of the Lancashire grant, albeit London would contribute a much larger amount to the new grant than the cotton county, and pays a higher School Board Rate. This may be very gratifying to Mr. Balfour's constituents, but it undoubtedly runs counter to common ideas of justice, and would loudly call for reprisals when a Radical Administration should have succeeded the Unionist Government, as in see-saw England will naturally happen in a few years. All this goes to show the unwisdom of Mr. Balfour's action, at the same time that it bears eloquent testimony to the statesmanlike prescience of the N.U.T. in recommending an all-round capitation grant of ten shillings, which, whilst relieving the intolerable strain in the case of the voluntary school, would at the same time relieve the oppressive burden of the School Board Rate. We do not believe that the present Government are likely to go back on themselves by bringing in such a measure, but we do believe that ultimately the Executive proposal will, in principle, if not actually, be adopted.

One admirable feature of the present controversy is the absence of internal strife amongst teachers themselves. Of course, it is too early in the day to prophesy that internecine wrangling may not, unhappily, again stultify the efforts of teachers who would fain fashion out a presentable Bill by judicious amendment of Mr. Balfour's proposals; but a great responsibility will rest upon those who make an unbroken front an impossibility by refusing to believe in the sincerity of those who differ from them. A give-and-take policy is the desideratum in this land of anomalies and compromises, where

> 'Tis with our judgment as our watches—none
> Go just alike, yet each believes his own.'

As to the Bill, it is certainly destined to become law—not, however, let us hope, in its present form. There is plenty of time, since the abandonment to the insatiable Sinking Fund of the £100,000 set apart for education last year makes a time limit no longer necessary.

Still, the House must not be expected to rise for the Easter Vacation with the Education Bill not passed, so that whatever is to be done must be done within the next month or six weeks, and

> 'If it were done, when 'tis done, then it were
> Well it were done quickly.'

And the hope of THE PRACTICAL TEACHER is that it may be done so effectually as to give teachers a good reason for remembering the name of the usurping Education Minister with gratitude, and for regarding his short term of usurpation with feelings of the liveliest satisfaction.

THE INSPECTOR'S NOTE-BOOK.

BY AN INSPECTOR OF SCHOOLS.

ELEMENTARY SCIENCE—THE DIFFICULTIES OF RURAL TEACHERS.

Elementary Science becoming popular. Elementary Science is becoming in many parts of England a popular class subject. Now that object lessons are compulsory in Standards I., II., III., it will tend to become even more popular. Let us then have a few words upon the teaching of this subject.

* * * * * *

Object Lessons in Standards I., II., III. are preferable to a course in Science. There are already many schemes in the market. Although several appear in the Code it is singular to note that very few schools follow any one of these. The very valuable and suggestive circular on object lessons, too, does not appear yet to have borne practical fruit. First, as to the lower standards. Is it preferable to take object lessons *per se*, or to start straight off with simple science? In my opinion object lessons are better. They accord more with the instruction received in the infant school. Scientific experiments, however simple, would appear to me to be too exacting for the minds of the ex-infants of Standards I. and II.

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Let the teaching be continuative. I scarcely think the method indicated in the Elementary Science Schedule of the Code can be bettered. The principle underlying the eleven courses there set out is that the instruction throughout the school is to be continuative, *e.g.* the Botany Course (C), in which the detailed study of the science is preceded in the lower standards by thirty appropriate object lessons (tea, sugar, coffee, cabbage, carrot, potato, &c.). This principle is sometimes violated, the object lesson list often being a heterogeneous compilation gathered from all quarters in hotch-potch fashion.

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Consult the works of well-tried teachers. It is no light task to draw up suitable courses for three separate standards, and unless a teacher has had plenty of experience of this business it appears to me she would do well to be guided largely by some of the excellent schemes prepared

by their most practical and experienced brethren. A head teacher should assist her assistants in getting up the object lessons by procuring them specimens, and lending them suitable books from which information may be obtained. Too often reliance is placed merely upon one text book, and that perhaps a science reading book.

* * * * * *

Science should be utilitarian as well as educative. Then, again, there is another question one often asks one's self with regard to this subject. How far ought the teacher to attempt to teach one particular science? Considering how short the school life of most children is, would it not be wiser to take up a course which should deal with the preliminary principles underlying many of the sciences? Many circumstances would have to be considered before arriving at a decision upon these questions. What would suit the town school would perhaps be unfit for the rural school. This Elementary Science has a utilitarian side. Whereas English is chiefly valuable as a means of developing the faculties, Elementary Science is taught for its practical as well as for its educative value. For example, some rural schools take Elementary Science in the form of Agriculture and Horticulture (*vide* Courses C and D, Schedule II. Supplement).

* * * * * *

Class subjects in rural schools. The mistresses of rural and small suburban schools sometimes consult me as to the choice of class subjects. In very many rural schools, where there are six or seven standards and infants, and where there is no help, it would seem to me pure folly to attempt two class subjects and Needlework for girls extra. I know of places where such is down on the time table, but it is impossible to do so much thoroughly. At most two class subjects, including Needlework, might be taken, and generally one class subject only should be taken.

* * * * * *

The teacher should teach what she thinks will be of most use to her scholars. Where this one class subject is taken, since object lessons are compulsory, there is very little choice. If the teacher is interested in Botany or Agriculture, then by all means supplement the lower standard instruction by one of these in the upper part of the school. Should circumstances be against Science, then give Standards IV.–VII. a course in English. Submit a scheme to your H.M.I. if you do not care for the Code syllabus. Much might be done under this head in the upper standards by cultivating, though humbly, a taste for literature, which would be preferable to a mere course in parsing and analysis.

* * * * * *

A few suggestions to those who take History. Again, Standards IV.–VII. might take History, and, as a matter of fact, I fancy that is the most general proceeding. In taking this subject care must be taken to vary the syllabus from year to year when several standards are grouped. In such cases, too, some trouble should be exercised to make the teaching interesting. This is much more difficult in the country than in the town. Pictures should be resorted to whenever possible. This reminds me that 'England's History,' a series of historical pictures, is published in sixpenny parts by George Newnes Ltd. I have myself seen the parts relating to the Tudor Period. They are bound to be a most valuable aid. Similar pictures, being photographs of various places all over the world, are often used in schools in the Geography lessons. Where your class is taking History for the first time it is unwise to take a special period without giving considerable time to a general survey of our history.

* * * * * *

Interweave your subjects wherever possible. Whilst considering the work of the rural teacher, I have another suggestion to offer which I venture to think from practical experience will be valuable.

I refer to the interweaving of the subjects. Economy of time and energies is a *sine quâ non* in a successful rural school. Let me illustrate. We will say that the class subjects are Geography and History. For the upper standards link together the Reading, Geography, and Composition.

A lesson is given upon the animals of Australia. This is followed by a Reading lesson, when the scholars recapitulate to some extent by reading upon the same subject. Finally, Standards V. and VI. have a Writing lesson, and fix the knowledge by expressing it on paper. The same plan might be adopted both with History and Elementary Science. As a general rule, then, let the subjects for Composition be chosen from the other portions of the curriculum.

* * * * * *

Group your children so as to get the maximum teaching power. In the case of the Recitation, work the English with it. Take the sentences for parsing and analysis from the selection for the year. This will be much more feasible if your English scheme is of the nature referred to above, where Literature bears a prominent position.

Of course you group your standards as much as possible for poetry. Select a Standard II. piece for Standards I., II., and III., and a Standard V. piece for the upper standards.

As yet the liberty allowed by the Small Schools scheme has not to any large extent been made use of. One still finds separate sets of reading books for the three lower standards. Granted that weak Standard I. children would be embarrassed if put to face a Standard III. reader, yet during the second half of the year no harm would be done by grouping Standards I., II., and III., for an easy Standard III. book, transferring possibly the best readers of Standard III. into the upper division for this subject.

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The monitorial system may still be used with discretion. In these most difficult schools oftentimes it is of advantage to call upon some of the smartest scholars as monitors. 'Necessity is the mother of invention,' is a proverb which finds ample exemplification in many of the rural schools. I know a young man who went straight from college to an out-of-the-way school, and the experience he there gained through being compelled to be always planning his work out, has been of immense value to him. He is now in charge of a large town school, and is applying successfully the knowledge of his craft learnt under difficulties. He used to get a lot of work done by monitors. No particular child was employed habitually, but several taught in turns. This benefited the school and the monitors as well. Then the biggest children should be trained to teach themselves to a certain extent. Give them plenty of opportunities to read by themselves. If you can instil into them a love of reading you will have accomplished much.

* * * * * *

A word or two about the tiny ones. Then of course there are your infants. They must receive a fair share of attention, or things will go badly in the standards. Arrange to give them a definite lesson each half day, if it be of only twenty minutes' duration. Work them in with the lower standards for object lessons and Writing, and put a forward girl to hear them read and count every day. It is highly essential that some definite instruction be given them daily in Arithmetic and Reading. Then in the afternoons give them varied occupations after the first lesson. It is useless keeping them all day at serious subjects.

Needlework and Drawing I have said nothing about. Of the former less need be said than of the latter. It is Drawing which many rural teachers find so difficult a subject to cope with. According to the *Schoolmaster*, there is some prospect in the near future of Drawing being inspected equally with all the other subjects by the Education Department's officials.

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University degrees for primary teachers. Correspondence has been dealt with by post this last month. I propose at an early date to take up and deal fully with the subject of university degrees as far as they interest primary school teachers. Any letters to me upon this subject suggestive of points which may be of use to teachers will be welcomed. They should be addressed to INSPECTOR, care of The Editor, 33, Paternoster Row, London, E.C.

MERRY SPRING TIME.

Allegretto spiritoso, mf. Words by GEO. BENNETT.

Treble
Alto
Bass
'Tis the mer - ry spring-time Makes all Na - ture gay, While the wood-land
Key A. Allegretto spiritoso, mf.
Treble
Alto
Bass
'Tis the mer - ry spring-time Makes all Na - ture gay, While the wood-land
min - strels Bid us haste a - way. Let us all to - geth - er
E. t.
min - strels Bid us haste a - way. Let us all to - geth - er
Seek the grove and dell, List the strains of free - dom That we love so
Seek the grove and dell, List the strains of free - dom That we love so
p.
well ; While the cuc - koo's call Has a charm for all.
f. A. p.
well ; While the cuc - koo's call Has a charm for all.

2. Spring is passing quickly,
April, May, and June,
With their scenes of beauty,
Fade away, how soon!
While with whitening blossoms
Tree and hedge are crowned,
While the jewelled flowers
Brighten all around,
And the cuckoo's call
Has a charm for all.

3. We have longed for spring-time,
Pictured it so oft,
With its balmy freshness,
With its lark aloft.
Now 'tis smiling round us,
Clear the sky above,
Let us show how welcome
Is the spring we love;
While the cuckoo's call
Has a charm for all.

TECHNICAL EDUCATION IN GERMANY.

If anything were necessary to convince the Government and the people at large that unless something is done, and done quickly, to put Technical Education here on level terms with the system existing in Germany we shall be compelled to yield to our rivals the first place in all the higher and more profitable fields of manufacture and commerce, then the Report on a Visit to Germany with a view of ascertaining the Recent Progress of Technical Education in that country will supply what is wanted. The Report takes the form of a letter to the Duke of Devonshire, and is signed by Sir Philip Magnus, Gilbert R. Redgrave, Swire Smith, and William Woodall, M.P., Sir Bernard Samuelson and Sir Henry E. Roscoe adding a note that they regretted they were unable to accompany their late colleagues of the Technical Instruction Commission to Germany. They had, however, read the Report, and were in general agreement with the opinions expressed in it. The 35 pages to which the letter runs will not be pleasant reading for those individuals who are always prating of England's superiority in everything under the sun! Sir Philip and his colleagues have rendered a distinct service in placing the position clearly before us. The enormous strides made by Germany in recent years, the large sums being spent on technical education, the encouragement given to students, the magnificent buildings and their equipment, together with the staff of teachers provided—all these are serious points for consideration by all who have the development of British industries at heart, and who wish to see the old country occupy an honourable position in any sort of competition with her many rivals.

Startling Statistics, &c.

The Commissioners' stay in Germany on this occasion was not a lengthy one, but it was long enough to enable them to visit some representative schools and factories and two important exhibitions, to discuss questions with influential educational authorities, manufacturers, and merchants, and to obtain reliable material for their Report. Moreover, they had the advantage of being 'personally conducted' by Chief Councillor von Diefenbach, to whom Würtemberg owes so much. Fourteen years before, they had made, as members of the Royal Commission on Technical Instruction, an exhaustive inquiry into the state of arts and industries in Germany. 1896 is, therefore, in the present Report compared with 1882. Where (in Bavaria, for example), at the former visit, there were workshops with but a sprinkling of artisans, there are now large and populous factories employing thousands of workpeople!

Two typical examples are given. In 1882 there was not a single Portland cement factory in Bavaria. Now, at one of the works alone, 300 hands are employed, and about 50,000 tons of cement are produced annually. Fourteen years ago the electrical works of Messrs. Schuckert & Co. (now the Elektrizitats-Aktien-gesellschaft) were only in their infancy; now 3,500 workpeople are employed, and optical and electrical machinery is exported to all parts of the world. Similar development is to be seen in lithographic colour printing works, such as those of Mr. E. Nister, of Nuremberg, where the entire staff comprises 750 workpeople, of whom 140 are well-trained artistic operatives. It is worthy of note, however, that nearly all the designs reproduced for the English market were the work of English artists.

The educational activity of Germany and the Continent was noted in the 1884 Report, and now we are told that in nearly every case the Commissioners 'found evidences of a determination on the part of the municipalities and of the State to increase and extend their schools, and to equip them with the most modern and improved apparatus.' At Nuremberg, for example, an entirely new building is in course of erection, at an estimated cost of £45,000. The new buildings for the Gewerbe Museum of Nuremberg will cost, when complete, over £50,000. At Stuttgart a somewhat similar museum (opened in May 1896) has cost nearly £200,000. At Darmstadt (population 57,000) the Polytechnic or Technical High School has been entirely reconstructed at an expenditure of about £120,000. When the 1884 Report was presented to Parliament, the Technical High School of Charlottenburg, in Berlin, was in process of erection. Since then it has been completed and extended at an estimated expenditure of over £450,000.

'Twelve years ago the Commissioners had to report that the facilities for practical laboratory instruction in electrical technology scarcely existed, or were of the most meagre kind. At that time nowhere in Germany was to be found so well equipped a laboratory for electrical engineers as at the Finsbury Technical College. Now there are no laboratories in England which can compare in the detail and completeness of their equipment with those we visited at Darmstadt and Stuttgart; and no facilities exist for original and independent research in physical subjects to be compared with those afforded at the Imperial Physical Institute at Charlottenburg.'

The Lesson to be Derived.

Sir Philip Magnus and his colleagues are agreed that the lesson to be derived from all this activity in the educational field is that Germany is 'determined to keep well ahead in the matter of facilities for instruction, and not only so in those institutions wherein the highest branches of scientific instruction are pursued.' Our rivals 'are convinced that the nation which has the best schools is the best prepared for the great industrial warfare which lies before us, and no money appears to be grudged for the erection, equipment, and maintenance of educational institutions of all grades, and especially of the science laboratories which, as we have seen, are being multiplied in Germany.'

We cannot, in these columns, deal fully with this interesting and important Report, but, by way of conclusion, we venture to give a few of the many points which deserve notice.

1. There is a marked improvement in the standard of living of the wage-earning classes, and a growing tendency to the shortening of the hours of labour.

2. The German railway system has been greatly developed and extended, and the railway rates for raw materials are very low.

3. Much more is being done for the training of those destined for the higher ranks of industry in many parts of Germany than in England, and this, too, notwithstanding the large sums entrusted to county councils and borough authorities under the provisions of the Local Taxation (Customs and Excise) Act of 1890.

4. It was Germany's belief in the future applications of chemistry to industrial purposes that led to the erection and equipment at a great cost of chemical laboratories, and to the encouragement held out to students to pursue their studies in those laboratories for a period of five, six, or even seven years.

5. The instruction in secondary schools is more disciplinary than with us, and exercises a deep influence in the formation of habits and in the training of character; the teaching of modern languages is insisted upon to a far greater extent than in any of our own schools, with results of the greatest possible benefit to the German clerk and commercial agent; the absence of frequent and conflicting external examinations gives more time for careful study; the remission of two years' military service to those who reach a certain standard in a secondary school is a powerful encouragement to steady application, and the fees are much lower than in schools of corresponding grade in this country.

6. Employers in Germany largely encourage their apprentices to attend evening schools, and in some industries the apprentices have two afternoons free each week for attendance at technical classes.

7. The export yarn trade of Bradford is practically in the hands of Germans.

8. Of the toys imported into this country in 1894, the value of which was nearly £1,000,000 sterling, nearly all came from Germany.

9. In all skilled industries the wages in Germany are rising, and the hours of labour tend to decrease. Child Labour has practically disappeared in German factories, as in no case at any works visited by us did we see any children employed.

10. In the attractive appearance, the pattern and the finish of their goods, and in the excellence of the packing, the

German producers take infinite pains, which it clearly pays them to take.

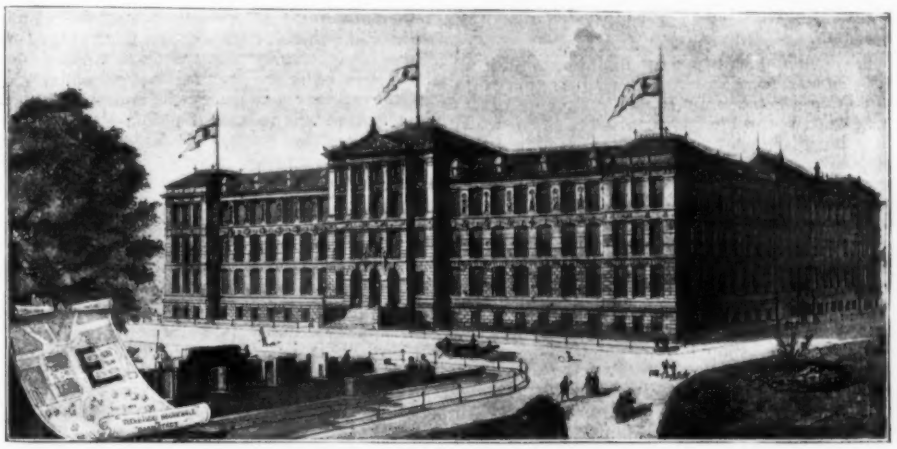
11. The Merchandise Marks Act, as it now operates, was generally spoken of as a strong weapon against ourselves, the measure tending to act as an advertisement of the industries of our foreign rivals.

12. In the coming struggle for trade, our fine insular position, our splendid race of workers, and our excellent raw materials will undoubtedly count for much, but we must not be content to live any longer upon the traditions and reputation of the past. We must set ourselves to work diligently to study the wishes and fancies of those we have to serve, and we must moreover be prepared to meet them even in such small subtleties as weights, measures, and packing. Above all, we must endeavour to improve and to develop our higher industrial and secondary literary and technical educational machinery, and, whilst adapting this machinery to our peculiar conditions, we must see that it is maintained at least on a level with that of any other nation.

The Darmstadt Polytechnic.

As has already been pointed out, our German rivals do not believe in standing still in matters educational. The several States appear perfectly willing to incur any expenditure in the direction of providing higher scientific education, and the newest German Polytechnic is one example out of many. The Technical High School had grown until even the eight separate buildings erected proved inadequate, this being caused chiefly by the rapid development of the electro-technic school, which has been in existence only fourteen years. Without loss of time the State authorities offered £27,250 for the erection of special electro-technic laboratories and their equipment, and the city of Darmstadt offered to take over the old Polytechnic buildings and to contribute the sum of £60,000 towards the erection of a completely new school. (The population, as we have already observed, is 57,000!) At once a beautiful site was selected, the plans were prepared by the State architect, with whom were associated Dr. Wagner and Dr. Marx, the two Professors of Architecture, who had been connected with the school for more than twenty years, and between 1893 and October 1895 the new Polytechnic was erected and equipped, the total cost being £120,000. The main building is three-storeyed, and comprises three wings at right angles to it, giving an E-shaped plan. Here mathematics are taught, together with some branches of natural science, architecture, and engineering. On the other side of the road, opposite to the front entrance to the Polytechnic, are two separate buildings, one the physical and electro-technical schools, and the other the chemical laboratories and class-rooms. In the rear of the main building is the engine-house, from which electric light and power and heat are supplied to all these buildings. The main building contains the usual series of drawing offices—a special feature of every technical college in Germany—rooms to contain the collections of models and apparatus, the engineering laboratories, class-rooms, lecture rooms, a large hall, the library, and the offices for the administrative staff. Clearly, the department of the institute most interesting to Sir Philip Magnus and his colleagues was the physical and electro-technical schools, one section being used for instruction in physics proper, including electricity, and the other for the technical applications of electricity. In the basement of the physical department are a room specially fitted with double walls for experiments requiring uniform temperature, rooms for chemical and photographic work, an engine-room containing a gas-motor, dynamos, and other machines. On the ground floor are separate laboratories for the professor of physics, Dr. Shering, and for the chief assistant; a laboratory for magnetic experiments, free from iron fittings, and other separate laboratories for galvanic, optical, and photometric work, and above this floor are the balance rooms, two lecture theatres, preparation rooms, and additional laboratories for exercises and experiments in heat and light.

The electro-technical section of this building has, on the basement, rooms for accumulators, for testing arc and glow lamps, for the testing of cables, besides the dynamo and engine laboratories. These are all carefully equipped with appropriate instruments and apparatus. The private laboratories of the professor, Dr. Kittler, and of his assistants, and the arrangements for lighting the lecture rooms and for the conveyance of currents from different combinations of batteries are very complete.



THE DARMSTADT POLYTECHNIC.

[*From* 'Nature,' *by kind permission of Messrs. Macmillan & Co.*

Already there are 300 students in this one department of the Darmstadt High School, and the building, completed only in October 1895, is *now being extended!* In the first year the students receive a general course of scientific study; the second is given up to physics, and the third and fourth years to practical exercise in the electro-technical institute.

In another separate building is housed the chemical school, one department being given up to the study of pure chemistry, the other to the study of chemical technology, electro-chemistry, and pharmacy.

During the past year the attendance of regular students in the various faculties amounted to 850, and there were 104 occasional students, making a grand total of 954 students. Turning to the teaching staff, we find 27 ordinary and 6 extraordinary professors, 22 demonstrators or instructors, and 22 assistants, a total of 77! Whatever deficit there may be in the cost of maintenance is met by the State, the students paying from £8 to £12 a year.

NOTES AND NOTIONS.

BY T. B. ELLERY, F.R.G.S.

Ex-President of the National Union of Teachers.

The New Education Bill. Writing before the Committee stage of the Bill is reached, one can say little that can be of practical value. At the last meeting of the Executive of the N.U.T. I moved a resolution demanding similar treatment for Board and Voluntary Schools, and I said then, as I say now, that the Government made a mistake in postponing the question of aid to Board Schools. Walthamstow was lost to the Conservative Party as a result of this policy—there can be no doubt about it. I believe that the resolutions which were passed by the Executive on the occasion to which I have already referred will commend themselves to all moderate men. Several were in the nature of a 'compromise,' it is true; but that does not make them any the less valuable. We do not all agree as to the abolition of the 17s. 6d. limit. Personally, I should like to see the limit removed, if I could have certain guarantees. But we all agree that the danger of the abolition of the limit is that managers may compel teachers to add to the already overburdened curriculum in order that large grants may be earned, and, further, there is the danger of a considerable falling off in local rates and subscriptions.

The resolutions passed by the Executive stated :—

(1) that the proposed grant is inadequate ;

(2) a Bill for providing aid for Board Schools should be introduced during the present Session ;

(3) that the increased aid should be specifically ear-marked for educational purposes (the school and the teacher), that there should be some element of public representation on the management, and that there should be a public audit of all school accounts by the District Auditor ;

(4) that compulsory federation is undesirable ;

(5) that the repeal of the 17s. 6d. limit is likely to reduce the local incomes of schools, and also to induce managers to add to the already overburdened curriculum of schools ;

(6) that all Voluntary Schools should at least have some show of voluntary subscriptions ;

(7) that the aid grant should be paid quarterly, as in the case of the fee grant ;

(8) that the aid grant should be at the rate of not less than five shillings per scholar for the whole number of scholars in those schools ;

(9) that if aid is extended to schools at differential rates, rural and small schools should receive the first consideration.

Federation. Of all the clauses in the new Bill probably those dealing with Federation concern Voluntary School teachers most. Under these clauses, if the Bill in its present form become law, I can quite see that many deserving and really necessitous schools (are not nearly all Voluntary Schools necessitous ?) will receive nothing.

With Federation there will necessarily be in each district inspectors, an office staff, and other expenses which must seriously reduce the amount available for the schools. Take the London Diocesan Board as a case in point. Will anyone contend that the 'management expenses' could not be more profitably employed in providing a more complete staff and better salaries and apparatus ?

The Unionist press is far from being agreed as to the merits of this part of the Bill, but it is worthy of note that several papers (Church and otherwise) which attacked 'Federation,' or 'Association,' at first, have now executed a *volte face*, and are now supporting the Government proposals. What this means I do not pretend to be able to say. The *Church Family Newspaper*, for example, in the issue of February 12th, apologises to its readers for having been 'not a little hasty in recommending' the withdrawal of the particular clauses dealing with this question. It may be taken for granted that Messrs. Yoxall and Gray will offer uncompromising hostility to this part of the Bill, and the best thing the Government can do is to give five shillings a head without conditions except those which secure that voluntary contributions shall be a reality, and that the extra grant shall be specifically ear-marked for educational purposes only.

The Willesden Dismissals. The Rev. J. Arthur Rawlins, of St. Andrew's, Willesden, must, I imagine, have exclaimed 'Spare me from my friends' when he read the leaders in the *Standard* and in other papers, touching the scandal with which his name has been associated. And what, I wonder, were his feelings when his denial of the charges brought against him was followed in the same issue of the *Standard* by a letter from each of the assistants concerned, placing the whole case before the public ? It is at the best but a sorry business, and the Voluntary School cause is badly served by this exposure, especially at a time when Parliament is called upon to vote a large sum of public money to preserve the system from extinction.

The *Standard* deserves the thanks of all interested in the Elementary Schools of the country for the rebuke it has administered to Mr. Rawlins—a rebuke which everyone will agree was richly deserved. The *Church Times* says: 'We are strongly of opinion that the vicar made a serious mistake, and that the teachers are deserving of sympathy.'

That teachers, *as a condition of service in the schools*, should be compelled to attend a particular church, without regard to special circumstances, is nothing short of monstrous. The exposure will do good if public opinion is aroused to the extent of securing fair and reasonable treatment of teachers in the nation's schools.

The Pupil Teacher Departmental Committee. In a note last month I ventured to suggest that a provincial teacher not connected with the centre system of pupil teacher training might profitably be added to the committee which had just been appointed to consider the whole question of pupil teachers. It is with considerable pleasure that I report the appointment of Mr. T. Clancy to serve on the committee.

Mr. Clancy's ability is well-known, and I am confident he will bring all his energy to bear upon this important work, and thus justify the action of the department.

We do not forget his splendid services in the lobby of the House of Commons at a critical time, nor the devotion and self-sacrifice he displayed in fighting the Southampton School Board on the question of Miss Goodwin's dismissal. As Chairman of the Parliamentary Committee and of the Parliamentary Election committee he is completely successful, doing excellent work in every direction. My hearty congratulations to my esteemed colleague on his new appointment !

The Orphan and Benevolent Funds. What are the Associations doing in the matter of the charities ? Conference will soon be here, and we must certainly not be content with less than a round ten thousand pounds. If every teacher in the land did his or her duty twenty thousand a year could be raised with ease. But there is too much apathy. Now and then, when enthusiasts get to work, there are those who throw cold water upon their efforts, and not only do next to nothing themselves, but seem anxious that others shall share with them the honour of the 'sweet doing nothing.' Thank God, these are the exceptions, so we can afford to ignore them. As Vice-Chairman of the Benevolent Central Committee I know what excellent work the funds are doing—widows cheered, old and incapacitated teachers relieved, the broken-down of all ages assisted, homes made happy. Blessings on the heads of all who assist in this glorious work ! And, then, who can follow the proceedings of the Orphan and Orphanage Council without feeling proud of the institution ? Where will you find boys and girls better cared for, better taught or trained ? This little paragraph in the Sheffield House Committee's Report to our last Council Meeting speaks volumes : "It was agreed that the time of one of the girls in the home be extended till after the Matriculation Examination in June."

If teachers would but visit the Homes and see for themselves what is being done there would be such enthusiasm with respect to the funds that appeals would no longer be necessary.

Just now, when collections are being made for the Indian Famine Fund and for our hospitals—objects which appeal irresistibly to all our hearts—let us not forget, my readers, the Teachers' Orphan and Orphanage Fund and the Teachers' Benevolent Fund—offices, 71, Russell Square, W.C., general secretary, Mr. J. H. Yoxall, M.P.

Well Done, Cheltenham! The Town Council of Cheltenham has invited the N.U.T. to hold the 1898 Conference in that pretty town. I believe this is the first time the honour of an invitation from a municipal authority has ever been received by the Union. Conference will do well to accept the honour, and I have no doubt that we shall all be of one mind when the time comes for us to vote upon the question. Well done, Cheltenham, and well done, Mr. Wheeler!

LIFE AT A GERMAN GYMNASIUM.

By an ex-Gymnasiast.

The inhabitants of Düsseldorf are wont to say that Cologne may be the biggest city on the Lower Rhine, but that Düsseldorf is the most important one. The boast is founded upon a substratum of fact. Commercially speaking, it is the river-side port of the busy Westphalian mining and manufacturing districts, and its own manufactures are very considerable. But Düsseldorf owes its fame chiefly to the attractions which it offers to the man of culture seeking the highest artistic and social refinement of Western-German civilization.

Düsseldorf was formerly a little fishing village, a small *Dorf* on the Rhine where the little river Düssel joins it. In 1189 it was sold, together with other possessions on the right bank of the Rhine, for £5, to the Count of Berg, whose ancient castle at Solingen is still pointed out to the excursionist. In 1288 it was created a town, and in 1385 it became the capital of the Berg dynasty. In 1611, after a series of terrible wars, it fell to the Elector of Pfalz-Neuburg. Johann Wilhelm, whose equestrian statue, covered with the green rust of two centuries, adorns the vegetable market, was the most notable man of this dynasty. He laid the foundations of the town's artistic eminence.

The Seven Years' War, and the wars of the French Revolution, told heavily upon the town, which was then a fortress. After many vicissitudes, it became part of Prussia in 1815. Since then its prosperity has increased rapidly. The fortifications were dismantled in 1801, and their sites are now marked by spacious avenues. The number of inhabitants increased from 20,000 to 120,000 in 1888, and is still increasing at the rate of 4000 per annum.

The Academy of Painting was founded in 1777, and has acquired a wide reputation. The artistic spirit has entered into every phase of the life of the town. Three fine art galleries, tastefully-planned public parks, a set of well-designed public buildings, and all kinds of artistic attractions and displays, lend an air of refinement to the place, which has drawn the lion's share of the wealth and intellect of the province to the former village on the Düssel.

The educational facilities of the town are of a high order. There are, besides numerous elementary schools, a middle-class school (*Bürgerschule*), a non-classical high school (*Realschule*), and one of those first-grade grammar schools which in Germany go under the somewhat inappropriate name of 'Gymnasium.' It is a public school without any boarding accommodation—the latter being almost unknown in Germany—and it provides the highest available education for very moderate fees. No student can enter for a full course at a German University who has not passed the final or *Abiturienten* examination of a gymnasium. Having passed through the full nine years' course of this gymnasium at Düsseldorf, from end to end, and come out at the top as a full-blown *Abiturient*, I had exceptional facilities for studying German school life in all its bearings.

The pupils usually enter the gymnasium proper at the age of nine, from the preparatory school (*Vorschule*), or by an entrance examination in the three R's. The first 'class' entered is the Sexta, in which every pupil must spend a full year. If his progress is satisfactory, he is then transferred to the Quinta, which is followed by the Quarta, Tertia, Secunda, and Prima. The last three are divided into an upper and a lower class, with a year's course each, making the full time nine years.

I entered the Sexta after a successful entrance examination, and was put into a class-room with forty or fifty other boys of the same age as myself. We sat on long uncomfortable wooden forms attached to the desks behind. There was no attempt at modern movable seats, so we had to write as best we could, and no attention was paid to posture. The class was in charge of one of the teachers, who is called the *Ordinarius* of the class under his care. He taught Latin and German. The other subjects, such as Arithmetic, History, Geography, Natural History, and Drawing, were taught by other members of the staff. Each lesson lasted an hour, and the school hours were from eight to twelve, and from two to four, with half-holidays on Wednesdays and Saturdays.

A typical school day would run somewhat as follows:—Rise at half-past six; breakfast at seven; leave home at half-past seven for the *Lindenallee*, where the gymnasium is situated, an old, square, massive building with no architectural pretensions; janitor rings the big bell at eight sharp; Ordinarius enters class-room and takes note of absent pupils, receives written explanations of absence, announcements of sickness, and similar routine items; class doors are closed, and any pupil entering after the teacher has taken his seat on the *Katheder* has to do some penance work or, if very late, to furnish a written explanation from his parents. We will suppose that the first lesson is Latin, given by the Ordinarius himself. He proceeds to collect the home work done by the pupils in books of the prescribed form, and to examine the pupils by means of translations from the text books, making a note of each pupil's performance in his private book. The day's lesson is then explained, the exercises in declension, conjugation, and the vocabulary are gone through. Finally, a certain task is set for working at home, usually a German passage to be translated into Latin. The bell rings at nine, and the Ordinarius is replaced by another master, say the Teacher of Arithmetic. He proceeds on the same general lines, and is relieved at ten by the bell which announces the usual twenty minutes' interval. The whole school pours out into the playground, where a space is assigned to each class. The noise from some 600 or 700 throats ranging in age from nine to twenty-one is deafening. In the playground, which is not very spacious, the majority of the pupils indulge in games, the most popular of which is *Ketf*. It is really a capital game where no football or cricket can be had. A couple of boys join hands and run out, trying to touch the others. Whenever one is caught, the three have to make their way back to the refuge as fast as they can, being freely belaboured on their way. The three now form a new chain (*Kette*) and run out as before. They have now a better chance of catching others, but the danger also increases of the chain being broken up. As soon as this happens, the members of the chain have to run in and re-form as before. When the chain becomes longer, a boy will sometimes desperately hew away at the joined hands of two members of the chain, endeavouring to break it up, at the risk of being touched and 'caught' by the end men. The game finishes by the whole class being included in the chain, which happens sooner or later; but the game is well-balanced and gives rise to unlimited fun. Fights are often indulged in too, pitched battles sometimes between one class and another, which are carried on fiercely until some teacher (there are always some half dozen about on the playground) intervenes and stops it. For a master to take part in any games would be considered a gross breach of decorum.

The bell rings again, and the various classes form into ranks, the youngest first, and march back into the class-rooms.

The next lesson is *Religionslehre*. Considering the importance of this subject, and the interest attaching to what appears to be a fairly complete solution of its many difficulties, it may be well to explain the system adopted in some detail. The Catholics and Protestants assemble in two separate class-rooms. There is no difficulty about this, since each class is divided, on account of its numbers, into two, which are called Sexta A and Sexta B, and similarly for the higher classes. The sub-division necessitates the existence of eighteen separate

schoolrooms exclusive of the *Vorschule*. This number, together with a large hall or *Aula* and the official residence of the Director, accounts for the large number of windows, close upon one hundred, which give to the building its barrack-like appearance.

During the hour set apart twice a week for *Religions unterricht*, the A and B classes combine, and sub-divide again into Catholics and Protestants. The teachers are appointed with the sanction of the State. The Protestant teacher is often an Ordinarius of some class, and is not a clergyman as a rule, although he is bound to have passed a theological university examination. The Catholic teacher is a priest, who occasionally combines the teaching of some subject, such as Hebrew, with the religious instruction. The Protestant instruction is governed by a certain curriculum of Bible knowledge, Church history, and modern theological criticism, combined with a good deal of semi-philosophical moral instruction. It is quite free from clerical control, and sometimes leads to a certain amount of friction with the Protestant clergy. The Catholic teaching is of course purely clerical, and includes preparation for Holy Communion in the Catholic Church.

In my time, now some fifteen years ago, the numbers of Protestants and Catholics were nearly equal. But of late the Protestants show a tendency towards a majority, owing to the influx of the more wealthy classes into the town. This is somewhat anomalous, since the gymnasium was founded with Catholic money for the education of Catholics. Even now the endowments are in Catholic hands, and the teachers and exhibitioners are almost exclusively Catholics. The contributions of the State are, I believe, larger than the private funds, and the approval of the teachers and the arrangement of the teaching system are in the hands of the State as represented by the Director, and, in the next resort, by the Provincial School Board (*Provinzial Schulkollegium*), which sits at Coblenz.

The religious lessons are supplemented by regular daily church services at the nearest church, on the Catholic side (7.30 to 8 a.m.), and by prayer meetings (*Andacht*) twice a week (7.45 to 8), on the Protestant side. The latter are in charge of the *Religionslehrer*, and comprise a few Bible readings, hymns, and prayers.

But to continue our school day. At 11 a.m. the Sexta classes distribute themselves into the regular A and B portions, and undergo the teaching of, say, Geography until noon, when the bell gives the signal for a general stampede home to dinner. For the great majority of the boys this mid-day dinner is the chief meal of the day, and so it is not surprising that the tramp back to school and the two hours in the afternoon are felt to be very irksome, especially when the tramp leads through snow lying three feet high, or over a baking summer pavement with the July sun shining down as it only can shine in Germany, and, I believe, in the tropics.

However, the laggard feet reach the great stone staircase again at 2 o'clock, or even a little earlier. The "sponge boy" —usually the pet of the Ordinarius—goes down to the pump to wet the sponge for the blackboard, and sees that the chalks are handy and in good order. The subjects chosen for the afternoon are usually lighter. We had Natural History, illustrated by specimens from the Botanic Garden, and elementary Freehand Drawing from 3 to 4, with a ten minutes' pause between. At 4 o'clock the boys went home for the day, except those who were kept in for an hour or so (*Nachsitzen*) as a punishment. On some days singing lessons were given from 4 to 5. They were semi-compulsory, *i.e.*, a comparatively slight excuse was taken for non-attendance, and the same system applied to the weekly choir practices on Saturdays, 12 to 1.

After coffee at home (corresponding to our tea) the home tasks were commenced. They were designed to occupy us for two or three hours, and consisted chiefly of translations, sums, and the learning of Latin words and dates. Thus the working day of each little *Sextaner* consisted of eight hours, unrelieved by any exercise, except the few minutes' games and the walks to or from school.

But then, to be sure, we had the gymnastics! Two hours a week, usually in the afternoon, were set apart for that. We used to contort our limbs on some old bars and things in the playground, and enjoy a glorious freedom when it happened to rain. For in that case the lesson was suspended. But that is all altered now. A *Turnhalle* was built on the playground and furnished with the most modern apparatus. A specially-trained gymnastic instructor was appointed, and we were taken through a carefully-chosen round of *Barren*, *Reck*, *Bock*, and *Strick*. And a very nice young man he was, poor fellow! He died in a couple of years or so of consumption, contracted in the dusty atmosphere of the *Turnhalle*. We survived, but then we had only two hours in it to his twenty.

(*To be continued.*)

IDOLA SCHOLARUM.

BY JOHN ADAMS, B.A., B.SC.

President of the Educational Institute of Scotland.

PART I.

WHEN Scott wishes to give a reason for Reuben Butler's occasional errors of judgment, he uses the palliative parenthesis: 'for the man was mortal, and had been a schoolmaster.'

When Bacon seeks to discover why men in general are so liable to those errors, he classifies under four heads the causes which predispose men to go astray; these are the four familiar *idola*. Since this word is used in a philosophical connection, it goes without saying that there has been a controversy as to its exact meaning. Those who are wrong take the view that it means the ordinary thing set up to be worshipped, a meaning that has exposed Bacon to severe censure from foreign critics. Hallam sensibly maintains that the word retains the meaning it had among the Greeks, and stands for an image as opposed to the reality, a false appearance as contrasted with the true nature of a thing.

Sir Walter's apology for Reuben makes an unconscious but very satisfactory classification of the four idols: the idols of the tribe, of the den, of the market-place, of the theatre. The idols of the tribe correspond to the causes that led Reuben to err as a mortal; the remaining three may be held responsible for his blunders as schoolmaster.

For the idols of the tribe are those to which all human beings as human beings are subject, such as the tendency to too easy generalizations, and to neglect contrary instances. Against those idols the schoolmaster must fight like an ordinary human being, a mere mortal.

When we come to the den, we begin to have a professional interest. 'The idols of the den derive their origin from the peculiar nature of each individual's mind and body, and also *from education, habit, and accident.*'* The 'mind and body' Reuben shares with other mortals, the rest applies to special walks in life, and to none more pointedly than to that of the schoolmaster. Most of our schoolrooms are veritable dens into which the master is led by idols born of his peculiar circumstances. 'Heraclitus said well that men search for knowledge in lesser worlds, and not in the greater or common world.'† True of all men, this is particularly true of the schoolmaster, who is apt to arrange all his conceptions to suit the limits of the lesser world of school, instead of fitting them to the greater world of life. If he be a secondary schoolmaster, a false quantity acquires a ridiculous importance in his ear, while if he be an elementary schoolmaster, parsing and analysis become the answer to the first question in the Westminster Shorter Catechism: *What is the chief end of man?* Things which in the greater world are only means, become in the schoolroom ends.

It is almost certain that Bacon founded this class of idols upon the figure of the cave in the *Republic*. As so many teachers live in the den, it is well to consider Plato's description:

'Behold human beings living in an underground den, which has a mouth open towards the light and reaching all along the

* Nov. Org., Bk. I. 53. † Nov. Org., Bk. I. 42.

den; here they have been from their childhood, and have their legs and necks chained so that they cannot move, and can only see before them, being prevented by the chains from turning round their heads. Above and behind them a fire is blazing at a distance, and between the fire and the prisoners there is a raised way; and you will see, if you look, a low wall built along the way, like the screen which marionette players have in front of them, over which they show the puppets.'

'I see.'

'And do you see,' I said, 'men passing along the wall carrying all sorts of vessels and statues, and figures of animals made of wood and stone and various materials, which appear over the wall? Some of them are talking, others silent.'

'You have shown me a strange image, and they are strange prisoners.'

'Like ourselves,' I replied; 'and they see only their own shadows, or the shadows of one another, which the fire throws on the opposite wall of the cave?'

'True,' he said; 'how could they see anything but the shadows if they *were never allowed to move their heads?*'*

All that this article aims at accomplishing is to induce the Cave-dwellers to move their heads. For they can move them if only they will. The chains round their necks and legs are only the chains of habit and indifference. So soon as the prisoners are convinced that there is anything worth seeing behind them, there will be little difficulty in turning round. The chains are self-imposed.

It is this unwillingness to turn round and look about them that marks the true Cave-dweller. Many teachers are content to play with the little black puppets of their school-world, and sturdily refuse to look beyond the school walls, or even to admit that there *is* a beyond.

It is reported that, in one of his rare lapses from massive common sense, Doctor Johnson said that everything that can be known about Education has been known long ago. To the teachers who to-day take a pride in repeating the saying, a qualified assent must be yielded. Certainly all that *they* know about Education has been known long ago.

Truth to tell, teachers trouble themselves very little about theories. So far as practical work is concerned, there is no trade or profession that stands less in need of exhortation under the text, 'Not slothful in business'; yet no occupation, claiming the rank of a profession, shows less interest in the theoretical aspects of its work.

So eager is the teacher in his occupation, that the ordinary laws of economics have to be suspended in his case, and regulations laid down to prevent him from working gratuitous overtime.† Little as teachers know of the literature of their profession, there are few indeed among them who have not heard of Arnold's classic requirement, that all teachers should be able and willing to go upstairs three steps at a time, and fewer still who are not openly proud of the requirement.

But after all, going upstairs—three steps at a time, or one—is surely not a teacher's ideal. Mere physical energy is not enough. For the dignity of the profession it is to be hoped that there is something for the head to do, there is surely room for some theory. The acquaintance of my readers with the treadmill is probably not sufficient to warrant me in using a very promising illustration, but some of them may have watched a squirrel working a wheel in his cage in a perpetual effort to reach a higher level. He works honestly and well, and certainly does not restrict himself to the three steps of the professional limit, but no one can give him much encouragement to persevere.

At first sight there is an air of modesty about the man who disclaims all pretensions to be an 'educationist,' who proudly proclaims that he is quite content to be a plain schoolmaster, whose business is to teach and not to talk about teaching. 'Give me a class,' says he, 'and I shall teach it. Do not trouble me about the science of education. There is no such science. Education is purely empirical.'

In the dictionary *empirical* begins with the meaning 'depending upon experience, or on one's own observation,' but it soon works its way down to 'quack.'

Closer examination shows up this modest schoolmaster as an arrogant and intolerant empiric—*empiric* is prettier than the other word. His position is summed up in whatever conclusion you may see your way to supply to the premises: 'A true schoolmaster is born, not made. I do not require making.'

Let it be cheerfully granted that a truly great schoolmaster is born, not made—but it must be added that a truly great schoolmaster is almost as rare as a truly great poet. The ordinary work-a-day poet, like the ordinary work-a-day schoolmaster may be, and is, made in numbers rather in excess—in the poet's case, at least—of the demand. Even a great poet needs a little making before he is quite fit for use, while a little one needs a very great deal of making.

There is a small and diminishing number of very superior teaching persons who sniff at training colleges, and do not respect even university professors of education. Such teachers do not require the practical work of the colleges, and despise the theories of the universities. Innate ideas have in their day been regarded as something very wonderful, and innate faculties have aroused even more awe. Both must sink into comparative insignificance compared with this marvel of *innate professions*. The knowledge of education possessed by the superior ones, reached their souls by no earthly inlet. They must have brought it, after the Platonic fashion, from a former and a better world. Professor Laurie earned the gratitude of all hardworking and modest teachers on the day that he entitled those others, 'Teachers by the grace of God.'

Yet to abuse those divinely certificated men here is to do a mean thing, to talk evil of them behind their backs, for none of them can be expected so far to forget himself as to read these pages. Such teachers are content to practise an art, the principles of which they do not understand, and they haughtily resent any attempt to enlighten them. They are poor prisoners in the Cave.

PART II.

LEAVING those few willing dwellers in darkness, let us look at the case of the many honest and earnest teachers who really do desire to get light upon their subjects and methods. At first sight there seems little to encourage such enquirers to prosecute their studies in the literature of their profession. Roughly speaking, that literature falls into two great sections. The first deals with what is usually known as school management, and is very valuable and indeed essential to young and raw teachers. But those of some experience and practical skill cannot be expected to content themselves with mere directions how to teach this subject or that. They therefore turn to the second great section, in which the books profess to deal with education as a science, and to lay down the principles on which the mere methods of school management are founded.

It is here that discontent arises. In the region of educational theory there is an intolerable lack of unanimity. Each new school brings its new theory, which contradicts all other theories. If one takes up an elementary historical sketch like Oscar Browning's *Educational Theories*, one finds the change from theory to theory so sudden as to recall nothing so much as the bewildering change of subject in reading the dictionary.

Nor is any very serious effort made to reconcile conflicting opinions. On page 312 of Quick's admirable *Educational Reformers* we find in a foot-note two fables—one by Pestalozzi about two colts, the other by Rousseau about two dogs. The first fable proves that the colts originally, 'as like as two eggs,' became widely different through nothing but education. The second fable shows that the vast differences that ultimately mark the two dogs of the same litter who have been 'treated precisely alike,' are the direct results of nothing but a difference of temperament. No comment whatever is made upon the contradiction involved, except that Pestalozzi's fable is 'a fit companion' to Rousseau's. Like a nineteenth century Herodotus, Mr. Quick tells the tale as 'twas told to him, and passes on to something else.

* Repul. VII. 514, Jowett's Translation.

† *Vide* the regulations of almost all the large School Boards against detaining children, *even for instruction*, beyond school hours.

Almost every characteristic utterance of a great educationist can be matched by its contradiction in the works of some other great educationist. Nor does this state of affairs mark the dark ages of our subject. At the present moment our professional organs teem with quarrels about the merits of conflicting systems of teaching various subjects, while the two most powerful general systems of education—the Frœbelian and the Herbartian—are built upon opposing philosophical principles.

Little wonder, then, that the teacher, tired of endless quarrels with no helpful outcome, should become disgusted with theories, and turn his face to the wall of the Cave and be content to be called names. He thinks that there are either no general truths, no science of education, or that such general truths are not yet available.

Some Cave-dwellers, indeed, glory in their shame, and adopt the position of the much-ploughed medical student, who maintained that his ignorance of anatomy was a positive advantage to him in surgery: 'You see those other fellows, knowin' every bloomin' nerve and vessel, are afraid to stick their knife in anywhere. As for me, I've no nervousness. In goes the knife, and there y'are.'

This ignorance is not to be overcome by supplying yet bigger and more formidable treatises on the Science of Education. For literary schoolmasters, more than any other class, have learnt the art of being dull by saying all that can be said on a given subject. It is because we live so much in the den that Littré, with the fine calm that nothing short of dictionary-making can give, dares to write:

'*Pédant*, a term of contempt, one who teaches children.' Pedantry is indeed our besetting sin, and nowhere does it receive a better illustration than in our love of completeness. A former Professor of Theology at St. Andrew's was asked how he treated his subject. The true spirit of the complete pedagogue is crystallized in the answer:

'I just begin wi' infeenity, and go right on.'

Our present lust for a professional literature is aggravating our naturally evil tendency. Education has not as yet a very secure place among the learned professions, and writers on the subject are tempted to justify their claims by the questionable method of making their books as formal and technical as possible. There is a growing tendency among educationists to assume an air of special knowledge on their own part and that of their readers that the facts of the case hardly warrant. One result is that ordinary practical teachers are repelled by the unnecessary difficulty and dullness of books which it would be greatly to their advantage to read. Philosophy has no longer any need to be brought from the clouds to the market-place. That work has been already well done. The humbler task remains to introduce it to the den.

The third class of idols—those of the market-place—arise from the associations of words and ideas. Bacon ranks them as the most troublesome of all. 'For,' says he, 'men imagine that their reason governs words, whilst, in fact, words re-act upon the understanding.'* Nowhere is this better seen than in works upon Education. It seems almost impossible in works of this class to speak perfectly plainly. The discourse has hardly begun when we find that we have introduced a metaphor. After that we are lost. Of a surety this metaphor will 're-act upon the understanding.' There is no more tyrannical idol in the whole market-place than a metaphor that has taken the bit between its teeth. A metaphor shows up a system as a deed shows up a man. By their metaphors shall ye know them.

Mr. Stelling, in *The Mill on the Floss*,† 'concluded that Tom's brain, being peculiarly impervious to etymology and demonstration, was peculiarly in need of being ploughed and harrowed by these patent implements. It was his favourite metaphor, that the classics and geometry constituted that culture of the mind which prepared it for the reception of any subsequent crop.'

In criticising this view, George Eliot proceeds to say: 'I only know it turned out as uncomfortably for Tom Tulliver as if he had been plied with cheese in order to remedy a gastric weakness, which prevented him from digesting it. It is astonishing what a different result one gets by changing the metaphor! Once call the brain an intellectual stomach, and one's ingenious conception of the classics and geometry as ploughs and harrows seems to settle nothing. But then it is open to someone else to follow great authorities, and call the mind a sheet of white paper or a mirror, in which case one's knowledge of the digestive process becomes quite irrelevant. It was doubtless an ingenious idea to call the camel the ship of the desert, but it would hardly lead one far in training that useful beast. O Aristotle! if you had had the advantage of being 'the freshest modern' instead of the greatest ancient, would you not have mingled your praise of metaphorical speech, as a sign of high intelligence, with a lamentation that intelligence so rarely shows itself in speech without metaphor—that we can so seldom declare what a thing is except by saying it is something else?'

When the above was written, the greatest metaphor of all, the truest and the best, but still a metaphor, had been long ago made, but was only as yet working its way slowly towards the conquest of the English mind. The plant metaphor is generally regarded as beginning with Pestalozzi, and holding an after-course through Frœbel and his followers, till* now it holds the vast majority of our profession in its relentless grip. Before Pestalozzi was heard of, wiseacres told each other that 'As the twig is bent so is the tree inclined,' but with him the simile passed into a metaphor, and embodied a way of regarding childhood that has become so widespread that its very opponents in attacking it are compelled to use its vocabulary.

Under all the popular words in our school management books, words dear to the heart of every ambitious young teacher, there lurks the inevitable metaphor with its underlying theory. Many of those words imply totally different systems, yet they are all used in the most friendly way on the same page. It is only because of the power of the idols of the market-place that this happy family arrangement can be maintained. *Faculty* and *capacity* are used as interchangeable terms, though they represent psychological views that are poles asunder. *Elicit* and *instruct*, *teach* and *educate*, *train* and *inform*, all hide different and indeed contradictory views of the function of the teacher.

So much for the market-place idols in their relation to the teacher's views on his profession. Their baneful influence is felt even more powerfully in the communication between master and pupil. But as the preceding essays are largely taken up with the effects of those idols, we may in the meantime pass on to the fourth class.

'The idols of the theatre are not innate, nor do they introduce themselves secretly into the understanding, but they are manifestly instilled and cherished by the fiction of theories and depraved rules of demonstration.'† Here again the schoolmaster is liable to fall an easy prey to the idols. Even the Cave-dweller who has rejected the popular guides to the theoretical parts of his profession is not without his theories, and he is more than human if he keeps them from affecting his work, by modifying all the facts of school life and experience to fit into them. According as he is a Calvinist or a Naturalist will he find his pupils little demons or little angels. If he be an idealist all the phenomena of the school-room will be made to fit into the formulæ of Kant and Hegel; if a sensationalist (a much more likely supposition) the children become so many receptacles for containing the knowledge which may be poured into them through the senses.

Consider the hard lot of the teacher. If he declines to meddle with theory at all, he is condemned to the den. If he seeks relief in figurative language, he is threatened with the idols of the market-place. If he accepts a definite theory, he is charged with yielding to the charms of the theatrical idols. The only hope of escape lies in common sense. A man must know all the theories in order to choose among them. He must be clear in his use of terms lest he mislead himself, not to speak of others. Finally he must make such use of the theory he chooses as his experience and intelligence direct.

* Nov. Org., Bk. I. 159. † p. 125. Stereotyped Edition.

* But see Comenius, the Great Didactic, V. 5.
† Nov. Org., Bk. I. 61.

OUR ART SECTION.

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INDUSTRIAL DRAWING IN ELEMENTARY SCHOOLS.

II.

In the February number I endeavoured to define the broad foundation upon which 'drawing in elementary schools' should be built. First, its potent force as a means of education should be fully recognised. This is essential to success. Drawing, such as we can do in our primary schools, is a means rather than an end. Put aside the fact that it is useful in some handicrafts, and indispensable in many others, and let it stand solely as a means of developing the various faculties with which we are endowed—and drawing will still be worth its place in an educational system.

[The term 'drawing' is meant here not only to include the expression of form with pencil or brush, but also in clay, wood, metal, cardboard, paper, etc.]

Be convinced of this educational value of the subject, so that in giving the drawing lesson, the aim may be much wider than that of merely reproducing a copy or model. You will find it pay in the long run, as far as developing the intelligence is concerned. Many lessons are given in school, not so much for the *information* conveyed by them, as for the mental *training* they give. Now that the days of cramming are doomed, the number of such lessons is increasing, and drawing may be accounted one of them.

Among all the civilised nations of the world, there seems to be perfect unanimity in recognising the educational value of drawing, and also its great usefulness from a utilitarian point of view, in arts and manufactures. But there is great diversity in the methods adopted for teaching it. In France, which is usually considered the most artistic nation in the world, the earlier exercises are all done on squared paper. Austria, Germany, and Switzerland follow a similar plan. In Belgium the paper is marked with dots in place of lines after the first year. American schools employ various methods in different districts, but the work is mainly done on plain paper —direct, unaided drawing. As is well known, here in England we do not make use of squared paper, as far as the earlier freehand exercises are concerned, but aid is given to the children in the shape of the ruler.

There seems to be a consensus of opinion that straight lines should form the basis of any scheme of drawing. It is often said that a child naturally draws curves first, and that, therefore, we should begin with curved forms at the outset. This is, however, somewhat fallacious, as there is an immense difference between the undisciplined and uncontrolled scribble with which a little child amuses itself, and the correct drawing of a very simple form. The former is merely a muscular movement, but the latter needs a mental perception of the form to be produced, before the hand should attempt to produce it.

The drawing of curves, however, should be introduced as soon as possible. There is really no reason why two whole years should be spent in drawing straight lines; though without doubt the mental power required to thoroughly appreciate a curve is greater than that needed for a straight line.

The wisest plan will be to follow the method best adapted to your particular circumstances. The course I lay down here has been evolved from many years of experience with large classes under varying conditions. I advocate the use of squared paper [one-inch squares] for *some* of the earlier exercises, because I have found that young children delight in pattern work such as shown in Figs. 3, 5, and 7. Such exercises need an accurate foundation to work upon, but whether the squared paper is used, or the children draw the base for themselves with a ruler, matters perhaps but little. One thing is certain, they will enjoy this kind of exercise.

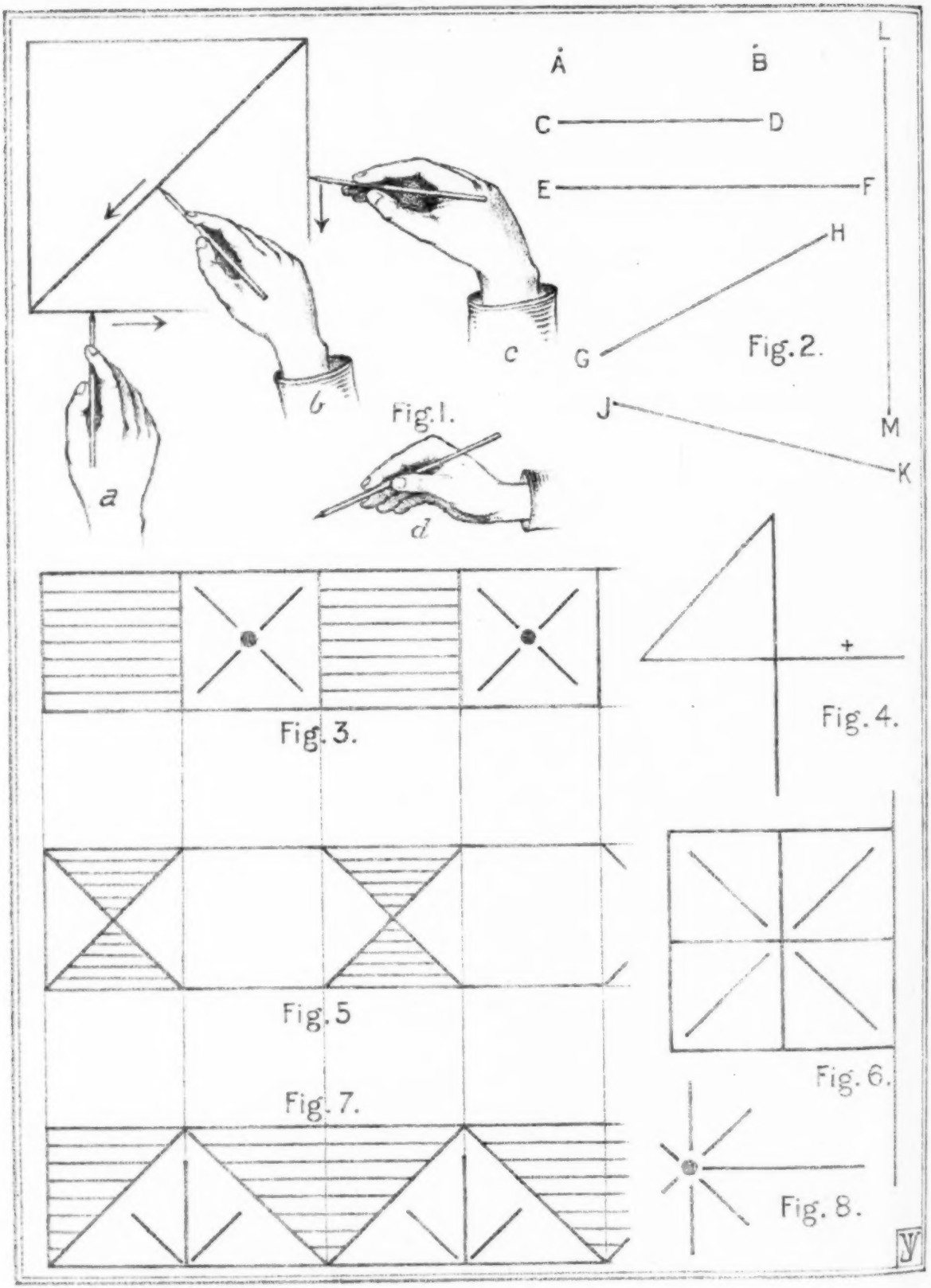
As the lessons proceed, you will see that squared paper is used in somewhat the same way for teaching drawing that lines are used for teaching writing. In the latter subject the double lines are first given for large text hand, then the narrow double lines for small text, then the single line, and lastly plain paper is used. Similar instances may be quoted in other work. Aids are given to start with, but are dispensed with as soon as the child is strong enough to run without them. Generally, where squares are used, *design* is the main aim of the lesson, but free drawing is carried on concurrently with it. I want to be clearly understood on this point, because, though aids of this kind may be productive of the greatest good if rightly used, they may also be made a channel for dry mechanical work. One other point is, perhaps, worthy of mention, *i.e.*, the squares are so useful for correcting errors. This is a point which will appeal to all practical teachers. We know how small a time can be given personally to any child in a class of sixty or so. All one can do is to go round, collate the errors as it were, and correct them from the blackboard. The squared paper enables the child to *appreciate* errors, and then to correct them. There is, however, no desire to render the work mechanical, or to cramp its freedom, but only to render just such help as the child needs at this stage.

Mr. Taylor, in his excellent book on Elementary Art Teaching, says 'The two advantages of the squared paper are that, from the first, a greater degree of accuracy may be reasonably looked for, and the work can be of a more interesting and extended character.'

As practical teachers we all know that interest is the mainspring of progress.

The accompanying illustrations are very simple, but some exceedingly valuable principles underlie their production.

Suppose you have a class of children just about to start drawing, what will be the first care? To see that they hold the pencil properly. I have often seen children holding the pencil in such a manner as to render free movement of the hand impossible. It should be held *lightly* between the thumb and forefinger, having the middle finger to rest upon. The forefinger should be nearly straight, and the pencil



SCHEME OF SQUARED PAPER FOR TEACHING DRAWING.

should not be pinched. Rest the hand on its side, rather than on the front, and incline the pencil to the paper at about 30°. Fig. 1*d* shows roughly the position. All this will require much patience, but it is well worth it. Practise movement of the hand first, without drawing lines. Drill work, we all know, is very tedious, though highly necessary, and ten minutes at any one lesson is ample.

The method of holding the pencil being mastered, attempt to draw lines. Now comes a most important principle, which is well worthy of your attention if you wish to secure good work. *The pencil should always be held at right angles to the line being drawn.* To make this clear I have given a little diagram—Fig. 1—of a square. You will probably follow the explanation much better if you take a pencil and draw the square as suggested. The hands are roughly sketched *in plan*, as it were, looking at them from above. Place the paper, or slate, with the lower edge parallel to the edge of the desk. Hold the pencil as explained above—two or three inches from the end, and pointing as in Fig. 1*a*—draw the horizontal base line, say 2 inches long, *at one effort*, from left to right. Not straight! No, but it will be with a little practice. You have the correct method of doing it, but complete success can only come after many such trials. Now take the vertical line, Fig. 1*c*. Since the line points north and south, so to speak, the pencil must point east and west, and the hand itself must be turned to bring it into position. Notice that you see more of the back of the hand in Fig. 1*a* than in Fig. 1*c*. It is placed rather more on its front in drawing horizontal lines, but gradually and naturally turns more on the side as it approaches the position shown in Fig. 1*c*. This will be quite apparent if you are actually using a pencil. Vertical lines are drawn from top to bottom.

Complete the square, and then draw the diagonal downwards from right to left. The hand, it will be seen, occupies an intermediate position between 1*a* and 1*c*.

Now try to put in the other diagonal. Turn your hand so that the pencil points north-east and south-west, to be at right angles to the line to be drawn. You will find it much more cramped than in either of the other positions, and personally I think it would be far preferable to slightly turn the paper to the right, until the line is in a similar position to JK, Fig. 2, than to attempt to draw it with the hand in a strained position. This of course is at variance to the rule of the Department, but it seems necessary for lines in this direction.

As soon as the method of holding the pencil to suit the varying direction of lines has been mastered, practice in drawing lines should be given. It is far better that these should not be drawn haphazard on the slate or paper. When drawing from a copy or an object, or building up simple designs, the lines will have to be drawn in definite positions, which should be marked *before the lines are drawn.* This idea cannot be implanted too early, nor practised too often. Therefore, in drawing simple lines it will be better to follow out the plan shown in Fig. 2. Before drawing any line put two dots to mark the extremities of the line. Place the pencil at A and draw a line to B with one effort. At first the two points should not be more than an inch or so apart, but with increased power the distance may be increased too, until a line three or four inches long can be drawn firmly.

Such exercises are best done by drill. Let *one*, say, be the sign to place the pencil at *a*. Look to see that the pencils are in the right position for drawing, and then count slowly *two, three.* The line should be drawn rapidly while these two words are being said. Practise lines in all directions and of various lengths. Treat such exercises exactly as you would mental arithmetic. A brisk five or ten minutes is quite sufficient at any one time.

Horizontal lines are drawn from left to right ; vertical lines from top to bottom ; oblique lines, as a rule, from top to bottom, though as they approach the horizontal position it is easier to draw them from left to right.

It will take weeks—nay, months, to master all these difficulties, but the result will quite repay you for your efforts.

You will not, of course, wait until every child can draw a straight line with certainty and ease before giving some little exercises as Figs. 3 to 8.

In Fig. 3 draw the horizontal lines at the top and bottom first. These had better be done one inch at a time, rather than attempt the whole length of line at once. Draw an inch at one stroke—move the hand—draw another inch, and so on. Then fill in the vertical lines. You will find it well, perhaps, to carry the drill system into a few of these earlier exercises, so that each line is drawn by the class at the same time and in the same time. For the shade lines in each alternate square have the middle one put in first—the position being judged at sight. Then the middle again, dividing the space into quarters, and lastly a line in the centre of these spaces. This will be their first exercise in judging space.

Now put a dot in the centre of the other squares—judged again from sight—and then the lines towards the corners. Border patterns may have as many repeats as time permits.

Fig. 4 provides an exercise in free drawing on plain paper.

Draw the vertical line first, as long as the children can manage at the particular stage, say three inches. The distance may be measured with a ruler if desired. Let the children place two points exactly under each other, as near as they can (as L M, Fig. 2), before drawing the line. It is really this stage which needs supervision. As far as possible, see that each child has the points in the correct position before attempting to draw the line. The actual drawing should take but a few seconds—locating the proper position takes up the time. Divide the line into two equal parts, and set off these equal distances on either side of the vertical line. It will take fully ten or fifteen minutes to do this properly, as so much explanation will be necessary, but the line itself can be drawn in five or six seconds. Next put in the diagonal line. It would, of course, make the drawing more like the actual figure if the horizontal line were cut off at +. As an alternative exercise, let them draw the figure 4 as they make it in their ordinary figures.

Fig. 5 will be done after the same method as used for Fig. 3, and needs no further explanation here.

Fig. 6 is a free drawing. Get the square first, setting out the points most carefully before drawing the lines. Divide each side into two equal parts and draw the diameters ; then put in the diagonals. This is really repeating a portion of Fig. 3 to a larger scale. See if the children have noticed which parts would be respectively red, white, and blue in the real flag—and the difference in shape.

Fig. 7 provides another simple border pattern. After a few such exercises let the children attempt a design for themselves similar in arrangement.

Fig. 8 is a conventional gnat form. It may be drawn in any position, and to as large a scale as possible. Draw the line representing the body first. Then put the dot for the head. Now draw in the two wings at right angles to the body and equal to about half its length. Next the intermediate lines in the centre of the space, their position being judged at sight. Lastly, the two small lines representing the antennæ.

Drawings of this description give excellent practice in rapid sketching.

Such elementary exercises form a very humble beginning, but it is well to put in a sure foundation upon which to rest the more elaborate and ornate superstructure.

I have before said that no attempt can be made to settle the amount of work which can be done in any particular school, but this paper will probably provide a good month's work for the very best. As with the brushdrawing, any queries relating to difficulties will be readily answered.

OUR LATE FRENCH PRIZE EDITOR.

MANY friends of the late Mr. J. J. Beuzemaker, B.A., B.Mus., have expressed a wish to establish some permanent record to his memory, and it is thought that an appropriate tribute—and one that would have been gratifying to himself had he been alive—would be to raise a sum of money to further the objects of the Modern Language Association, of which Mr. Beuzemaker was the founder and Chairman up to the time of his death. Should any of our readers wish to add their names to the list of supporters, they are asked to communicate with Mr. R. Kershaw (Executor), 45, Devonshire Street, Portland Place, W. Whatever amount is raised will be handed over to the Treasurer of the Association, after making a small deduction for the erection of a simple monument to mark the spot where Mr. Beuzemaker's remains lie.

BRUSH DRAWING.

III.

We come now to the third stage of the work. The new element is the 'double blob,' and this, combined with the units previously learnt—the single blob, dot, and straight line—produce the patterns shown in the accompanying illustrations.

I have been asked whether children at this stage, say Standards I. and II., should ever attempt to record their own impressions of natural forms? Undoubtedly they should, but you must be careful to give them only such objects to reproduce that they may reasonably be expected to do. I have seen a class in an Infant School attempt the chrysanthemum, and, as may be expected, the result was an absolute failure. But there are many forms, such as an acorn, a pea-pod, a lemon, a couple of cherries or grapes on the stalks, single leaves of privet, lilac, bay, laurel, clover, shamrock, lime, genista, etc.—in flat treatment, for form only—newly budding twigs, simple shell forms, and many others, where the shapes are well defined and have but few details. As a rule, even simple flowers have far more detail in them than little children can express. They may see it all, but their technical skill is not great enough to enable them to convey the idea to paper, so that the child's drawing is not really a faithful reproduction of what the eye has seen, but is rather a measure of his technical skill. This, however, is not the case with the simple forms enumerated above, as practically these have only two dimensions, and all the child has to grasp is the general form and structure. With complicated things, children at this stage will probably learn more about the flower or object by making a conventional drawing after the teacher's pattern, such as Fig. 11, for the primrose or marsh-mellow, Fig. 13, for oats, etc.

From the simple leaf forms they will pass to the more complex, as the horse-chestnut, dandelion, maple, lupin, etc., still treated in the flat. Then will come the simplest type of flower, as the snowdrop, the bluebell, geranium, buttercup—represented naturally.

The point at issue is this. Is it the right educational principle to let children attempt things which are manifestly beyond them, in order to see how far they can go; or to give them such things that they may reasonably be expected to do—mental and technical skill both considered?

Perhaps some one will answer this question briefly, but in any case there need be no doubt that drawing from objects and from nature, as well as from good copies, should go hand in hand.

Practice in making the double blob must first be given separately. It is produced by putting two single blobs together, meeting either at the point, as in Fig. 1, or at the base, as in Fig. 13. If possible, have several leaves to show the children the origin of these forms—a primrose petal, lilac, lime, or shamrock leaf, oat husk—and make comparisons between these forms and others more or less remote. Note, for instance, the difference in shape between a lilac and a bay or laurel leaf, or between the petal of a primrose and that of a dogrose. Such lessons must be given if you would have the work interesting and educational. Brush work, like any other subject, may become a mechanical exercise, if it is merely a dull repetition of copied forms, without bringing the child's own powers of observation into play, or stimulating its natural curiosity and spontaneity.

Exercise 1 is very simple and needs no explanation. Such a pattern may be readily made, and would prove more interesting, by pinning natural leaves on to a strip of paper fastened on the black-board. In Fig. 2 put the single vertical brush impressions first, then the double blobs, drawing a diagonal pencil line as a guide if necessary. Next, fix the position of the berry, or two may be put in, as shown in the end square. Lastly, add the straight lines. Fig. 3 should have the double impressions located first, then the squares surrounding them. Next put in the lines radiating from the centre, and add the border lines.

Fig. 4 is an example of a vertical border. Draw the double blobs first, putting in the diagonal line for a guide if it is needed. Notice that the short straight lines are parallel respectively to two sides of the squares. Fig. 5 is an exceedingly interesting border pattern, and may be used either horizontally or vertically. The alternate units can be done with different colour. The gradation of colour will probably be noticed more in the present sheet than in any previous one. As before stated, this accidental running of the colour produces a charming effect, and gives some beautiful tones—oftentimes far better than any thought-out scheme. The effect may be further enhanced by employing two colours as follows:—Make the impressions in the usual way, and then, while wet, take a brush filled with another colour, and put a touch of this second colour at the point or base of the first stroke. For example, suppose the double impressions in Fig. 4 have been put in with orange. While this colour is wet, take another brush filled with brown, and put a touch at the bottom, just where these forms show darkest. The brown will spread gradually into the orange, and produce some most lovely gradations ranging from pure brown to pure orange. To do this successfully it will be necessary to make three distinct operations as it were. After doing the three (or as many as you like) at the top, a sufficient pause must be made for the colour to get fairly dry. Then reverse the paper and do the corresponding three units, and again allow a short time for these to get dry. Then turn the paper upright and complete the remainder. It will be seen that if the paper were turned upside-down while the colour was very wet, we should get little or no gradation, but a mere mingling of the colour, somewhat the same as though it had been mixed on the palette. Another way of producing the same effect is to fill the brush with orange, and then dip the tip of it into brown. The advantage of this is that one brush only is necessary, but after a few strokes the colours mingle in the brush, and it needs washing before going on. Before employing this method, it is higly essential that *colour* itself should be understood, or some very disagreeable results will follow.

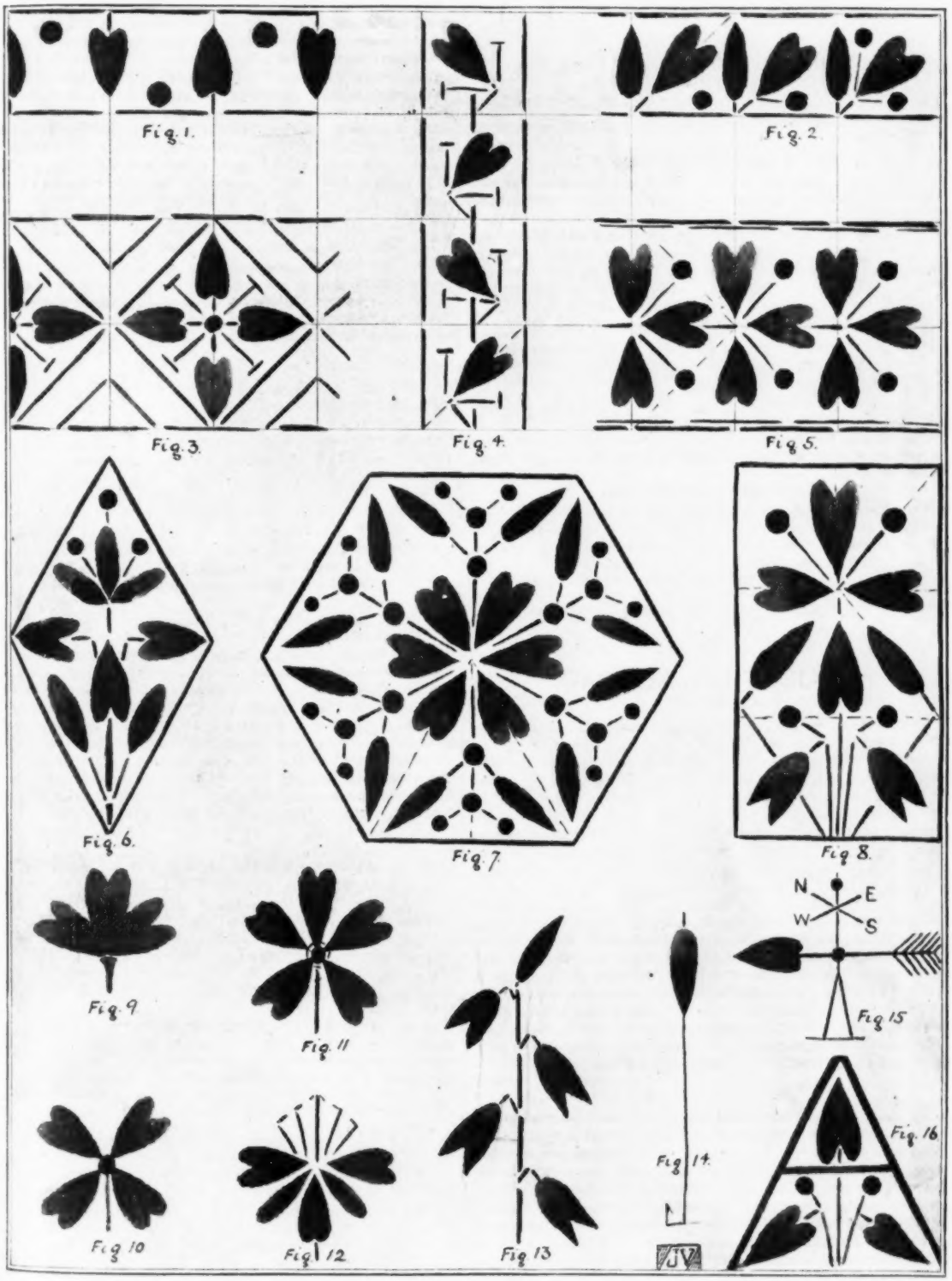
Figs. 6, 7, and 8 are examples of simple space-filling, with the units we have at our command. The figures should be drawn with the ruler on plain paper, or to save time they may be drawn with a template. In Fig. 6 the two diagonals would be quite sufficient as guide lines. Put in the brush impressions first, and add the stalks afterwards. All these figures should be done about one-and-a-half times the scale shown here.

Fig. 7 is rather complicated in appearance, but properly ordered, the working out will not be difficult. Having drawn the hexagon, put in the diagonals, and arrange the six double impressions round the centre. Next put in the six dots between these, forming really another hexagon. Now locate the single blobs in a direct line between these dots and the corners of the hexagon. Put in the groups of three dots, and add the straight lines. Such exercises as these are far better worked out in two colours—the six double impressions say in red, and the remainder in deep green, or brown, or light blue. The rectangle in Fig. 8 should be first divided into three equal parts. It will then be seen that the positions of the various units composing the design are readily ascertained.

The remaining exercises are to be done on plain paper. If they are produced by the blob, the size will of course depend upon the size of the brush used; but you may, perhaps, now try to have some of the simple examples drawn to a larger scale, as an exercise in free drawing.

Always have the type flower, leaf, or object before the class if possible when doing these, such as the shamrock for Fig. 9, primrose or marsh-mallow for Fig. 11, common stock for Fig. 10, oats for Fig. 13, etc.

As before suggested, the exercises on plain paper should alternate with those on squared. The present illustrations may be done in the following order:—Figs. 1, 2, 9, 14, 3, 4, 10, 12, 6, 11, 5, 8, 13, 16, 7, 15. The actual execution of the examples on plain paper is, of course, no more difficult than on the squared, but the judgment required to place the elements in proper position gives most useful training. When the units are disposed round a common centre like Figs. 10 and 11, the positions should be first lightly indicated with the brush or pencil. Similarly with Fig. 13, draw the short equal sections of the upright line first, to give a standard to work to. It is very



DESIGNS FOR BRUSH DRAWING.

The squares, as usual, represent 1 inch. Exercises 9 to 16 should be drawn to as large a scale as possible.

desirable in freehand drawings to set out the main proportions of the example before beginning to draw, but in brush drawing this principle is essential.

OUR PRIZE COMPETITIONS FOR SCHOLARS, STUDENTS, AND TEACHERS.

THE time is perhaps not yet ripe for competitions in connection with the Industrial Drawing, but the first series for Brush-Work is as follows:—

For Scholars under the age of 8.

Copy Figs. 1, 2, 3, 4 (to show six repeats), 6, 9, 10, and 14, and make one original design for a border, using only the elements learnt up to the present stage. FIRST PRIZE, 5*s.*; SECOND, 2*s.* 6*d.*

For Scholars between the ages of 8 and 10.

Copy Figs. 3, 5 (to show six repeats), 6, 8, 11, 12, 16, and make one original design for a border and one to fill a square of 3 inches, using only the elements shown in the plate. FIRST PRIZE, 5*s.*; SECOND, 2*s.* 6*d.*

For Scholars between the ages of 10 and 12.

Copy Figs. 3, 5 (to show eight repeats), 7, 8, 11, 13, 15, and make an original design for a border 2 inches wide, another to fill a circle 3 inches in diameter, using only the elements contained in Fig. 7, and draw from nature one of the simple forms mentioned in paragraph 2 of the current article. FIRST PRIZE, 7*s.* 6*d.*; SECOND, 5*s.*

The Teacher's signature will be taken as a guarantee that the specimens sent in are the *bonâ fide* work of the children whose name they bear.

For Teachers and Students.

The 16 examples shown in the plate should form the basis of at least as many others, and we offer a Prize of Half-a-Guinea for the best set of original designs, suitable for use as alternative exercises to those shown here.

Specimens must be accompanied by the Coupon cut from the current number, and should reach the office of this Journal not later than March 31st, addressed 'Art Section Competition.'

EDUCATION ABROAD.

IN the January number of the *Record of Technical and Secondary Education* will be found a summary of the report of the Irish Recess Committee on the development of the industrial resources of Ireland. It will bring home to the English reader the state of things prevailing in an island which even now is to a great extent a foreign country, with a radically different administration and educational system. For the first time in history, the widest problems of technical and agricultural instruction have been taken in hand by a body of representative Irishmen, headed by the Right Hon. Horace Plunkett, M.P., and supported by the best native and foreign expert opinion. There is at present practically no technical education in Ireland, if we except the schools established by the Dublin Corporation and the two agricultural schools under the Board of National Education. To undo the work of centuries of discouragement, and to bring Ireland into line with modern industrial progress, is a truly herculean task. Now that the men have been found to take it in hand, and the Government is favourably disposed, it may be hoped that we shall soon see the dawn of a new era.

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IT must be confessed that the movement for manual instruction is not without its formidable enemies, who have a good deal to say for themselves. In Denmark and Sweden most of the objections on the industrial side have been overcome by developing the 'gymnastic' aspect of the work almost exclusively. In Germany it is only in the larger cities that manual instruction has taken root. Berlin and Leipzig have taken the lead, and the recent exhibition of boys' work in Berlin has brought the matter prominently before the public. An outcry was raised in some quarters against the waste of physical and mental energy in producing a collection of articles of doubtful utility. But the work of Salomon and Mikkelsen is bearing fruit in many countries, and what is truly beneficial in it will have no difficulty in surviving.

IN Paris the threatened abolition of manual instruction has met with a vigorous protest from the Mechanics' Union of the Seine Département. 'The school workshop,' says their resolution on the subject, 'ennobles labour and gives the child the healthiest sentiments with regard to his moral instruction, making him understand that the tool is as honourable as the pen. It is a great service in itself to divert his attention from the liberal professions, whose overcrowding gives rise to the lack of employment from the effects of which the community is suffering.'

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SOME interesting items in this connection may be culled from the Swiss Budget for 1897. The total federal revenue is 3½ million pounds, or say a thirtieth of that of the United Kingdom. Out of this no less than £30,000 are spent on technical education, and additional sums are voted for artistic, horticultural, and agricultural instruction amounting to another £28,000. Some curious items are the work-table at the Naples zoological station, £120; forest photography, £40; and avalanche statistics, £200.

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WILHELM TELL'S native canton, that of Uri, shares with Appenzell the distinction of having the maximum number of illiterates among its recruits. The average for the last ten years is 27 per cent., against the average for all Switzerland of 14 per cent. It is now about to adopt some drastic measures to put a stop to this state of things. A plan proposed by the Board of Education of the canton provides for a compulsory continuation course extending over three years, with 60 lessons each. All youths between the ages of 16 and 19 are to attend under severe penalties. About 46 per cent. of the population derive their living from non-agricultural sources, among which the St. Gothard railway occupies a promiaent place.

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THE Photoglobe Society of Zürich has brought out a series of magnificent chromatic photographs for educational and other purposes, an account of which will be found in No. 2 of the *Deutsche Blätter*. The three-colour process is so far the only commercially successful method of photography in natural colours, and the prices, which range from one to ten shillings, place the well-finished product of the more modern improvements within reach of the masses. The photographs are chiefly landscapes from Europe, especially Switzerland, and Palestine, Egypt, India, etc. They are intended to facilitate geographical, historical, and Biblical instruction.

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TO those interested in the history of the French language —a subject which is not very widely studied among us—I should recommend the perusal of a well-written series of articles in the Paris *Journal des Instituteurs*. The three divisions of the country mentioned by Cæsar had each their own language. Remains of the ancient Gallic are still lingering in the Bretagne, and the language of Aquitania has found a refuge in the Basque provinces. As regards the Belgæ, their language was probably allied to some Teutonic or Flemish dialect. The Celtic languages in the centre and south have had to give way before the richer French and Spanish tongues, just as in our own 'Celtic fringe,' with the exception of Wales, English is replacing Gaelic and Manx.

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MARTINIQUE, the most valuable of French possessions in America, is placed in an anomalous situation with regard to its educational needs. The schools were placed under lay management in 1881, and teachers were sent out from France to fill the new vacancies. They had hopes of high salaries to compensate for the disadvantages of climate and the greater expense of living. In 1890, when salaries in Algeria were raised above those in France, those in Martinique were lowered. The pensions obtainable in the island are a little more than half those given to Algerian teachers, and the medals and honourable mentions which give a certain zest to school life in the mother country are unknown in the West Indies.

UNIVERSITY extension is a matter in which England and France, and even Belgium, are far ahead of Germany, which prides itself upon its educational advancement. Strassburg, Munich, Leipzig, and Berlin are the only cities in which the idea has as yet taken root. The Bavarian capital has taken the lead. Hygiene, political economy, mineralogy, physiology, and ordinary civil law are the subjects to be dealt with in a series of lectures by university professors. In Leipzig the lectures will be more historical, dealing especially with recent German history. The Berlin Committee has, somewhat characteristically, asked the Government for a grant of £750, and has promised, as a *quid pro quo*, to carefully avoid all subjects connected with current social, political, and religious questions. Elsewhere, the financial burden is borne entirely by private societies or individuals, and the syllabus is not limited to subjects of no immediate interest. A great source of strength to the movement is the existence of an expressive and appropriate name. The system is to constitute a '*Volkshochschule*—a People's University.

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THE February number of the *Pädagogische Archiv* reprints a strong attack upon the present Gymnasium System, embodied in a speech by Oberlehrer Ohlert in Munich. The classical system at present in vogue, he says, is based upon an unfounded and ill-advised idealisation of Greek culture which is derogatory to the dignity of German nationhood. It is, besides, out of date. Greek should only be cultivated as far as it is necessary for the purposes of history and etymology. Pupils should be brought up in German traditions and enabled to understand actual modern life and modern ideas. German language and history, and science are to be the chief subjects. Latin is to be postponed to a higher stage.

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AN almost precisely opposite attitude is taken up in the same paper by A. Wernicke on the question of higher school reform in Hamburg. There are to be three high schools: the Gymnasium for the learned professions, the Realschule for technical and industrial pursuits, and the Realgymnasium, a mixture of both, for commercial men. The first and last are to teach Latin to the same extent, beginning with the Sexta. The technical Realschule, or, as it is here called, Oberrealschule, is not to teach Latin at all, but is to pay special attention to French and English. That, we should say, is a very good arrangement. But Herr Wernicke pleads that if a tradesman is to know Latin, an engineer will not be satisfied until he knows it too, and Latin must be taught in all the three schools.

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WE have received a copy of the *Pädagogische Jahresbericht*, annually issued by Brandstetter, of Leipzig. It is an admirable summary of educational advancement in German-speaking countries, and consists chiefly of reviews of publications which appeared in Germany, Austria-Hungary, and Switzerland during the year. The *Bericht* is arranged by subjects—including meteorology, languages, juvenile literature, drawing, gymnastics, hygiene and other school subjects—and also by countries. The latter part forms an exhaustive record of the progress made by each of the countries dealt with. If it could be made to include other countries, its value would be many times multiplied.

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THE January number of our German namesake, *Der Praktische Schulman*, contains a series of highly interesting original articles on a variety of subjects. Among these we must draw special attention to Albert Richter's paper on German prefixes, beginning with *be*, which we know is the most frequent syllable in the German language; to that by T. Westphal on modern scientific education; and to H. Dannenfeldt's admirably lucid exposition of the work of the dynamo. There is also an article on the rise and fall of the Hansa, that remarkable combination of German cities which almost monopolised the European sea-carrying trade before the advent of the Dutch and the English.

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THE *Rinovamento Scolastico* gives some details of the recent students' riots in Italy. They have assumed alarming proportions. Beginning at the Bologna University in the hooting of a minister, which was punished by severe rustications, they were complicated by the declaration of sympathy of the students of the University of Rome, and by the resolution adopted there, which runs as follows:—'We, the students of the University of Rome, in general meeting assembled, resolve not to attend any lectures until the *Ateneo* has been cleared of police; till the Rector has been dismissed from a post for which he has shown himself to be incapable; and till the punishments inflicted upon our fellow students are revoked. We appeal to the solidarity of our colleagues at the other universities in this matter, and are prepared to declare our sympathy with all fellow students under punishment.' The appeal has been responded to by all the other universities, and a deadlock has been created, of which it is difficult to see the end. That the same discipline should prevail at a university as at *tutti i nostri istituti scolastici*, as our contemporary hopes, is hardly to be expected of students, to judge from the experience of other countries.

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AFTER a prolonged depression, consequent upon the retrenchment measures adopted in Australia at the time of the banking crisis, the tide has begun to turn in New South Wales, where the Legislative Assembly has voted an increase in teachers' salaries amounting in the aggregate to £7,600. A first assistant holding a first-class certificate and working in a school of the first class receives now £225, or £150 if female.

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IN Queensland, according to a report published by the *Educational Journal*, it is proposed to make a half-way house towards Superior Public Schools by teaching mathematics, higher English, science, and drawing to the children in the highest class, with optional manual instruction.

OUR SCOTCH LETTER.

The next President of the E.I.S. } The various branches of the Educational Institute are evidently determined to be in good time with their nominations for the office of President for next year. The election does not take place till September, and already quite a number of branches have made known their intentions in this matter. So far, Dr. Campbell, Rector of Falkirk High School, is the only gentleman nominated, several of the larger associations, including Glasgow, Aberdeen, Ayrshire, and Hamilton, having declared in his favour. The Glasgow Branch can now afford to take up again their nominee of two years ago, whom it suited them to drop at the last election. Dr. Campbell has done yeoman service to the Institute, and would make an excellent President.

District Representation. } Mr. McCallum, the convener of the sub-committee appointed to consider the vexed question of District Representation, is seemingly not satisfied with the result of his committee's deliberations, and yet another attempt is to be made by the young bloods to revolutionise the management of the Institute. It will probably again be found that there are strong objections to reducing the number of members of the General Committee, more especially at a time when the Institute membership is going up by leaps and bounds.

A New Magazine. } Teachers in country schools, who have to prepare either themselves or their pupils for examination in French, will watch with interest the development of the new magazine 'French Why's and Wherefore's,' which recently began its course in Edinburgh. Its object is to aid the English-speaking teachers of French by criticising translations, answering queries, and supplying notes and explanations on difficult grammatical points. The genesis of this venture is to be found in an advanced private class for the study of French, whose members when dispersed felt the want of a reliable settlement of the many points of difficulty which lie in wait for the teacher in his daily work. The numbers of the paper already issued give good promise that it will fulfil its aim, and the name of M. Léo Melliet, B.A., LL.B., as editor, will be a guarantee of reliability.

Religious Instruction in Board Schools. The annual general meeting of the members of the Association for aiding School Boards in the Inspection of Religious Instruction was lately held in Edinburgh. The Secretary's report showed that during the past year 429 schools had been visited and reported upon by the Association's Inspectors, as compared with 385 in the preceding year. One of the Inspectors remarked that it was a pity they could not do something in the way of grants and prizes for the children. He also felt that they ought to give the teachers every sympathy in the work they did.

Dunecht College. A company is being formed to inaugurate and conduct an establishment of the first rank for the education of the sons of gentlemen on the lines of Eton, Rugby, Harrow, &c. The mansion-house of Dunecht, Aberdeenshire, is to be acquired for the purpose, and accommodation is to be provided for 200 boarders. Amongst the directors are Sir William Geddes, Principal of Aberdeen University, and Dr. Kerr, late H.M. Chief Inspector of Schools for Scotland.

Western Secondary Teachers. At a recent meeting of the Western Branch of the Association of Teachers in the Secondary Schools of Scotland, Professor Steggall, University College, Dundee, read a paper entitled, 'Some Inquiries and Suggestions concerning the Teaching of Elementary Mathematics and Physics.' The Professor argued that the teaching of these subjects in schools should be more restricted, and should aim at thoroughly grounding the pupils in the fundamental principles of the subjects rather than at enabling them to get up mechanically a large number of results which would tell at an examination.

Sewing in Schools. The sub-committee appointed by the Glasgow Branch of the E.I.S. to consider the question of Sewing in Schools makes the following recommendations: (1) That School Boards in the district have their attention drawn to the fact that classes for sewing are in many cases too large, and that the Branch deprecates the imposition by School Boards of sewing requirements not demanded by the Code. (2) That the Education Department be approached with a view to a modification of the sewing requirements in the following particulars: (*a*) The 'cutting-out' requirements should be simplified and lessened; (*b*) The regulation anent washing and dressing of specimens should be withdrawn; (*c*) Effect should be given to Mr. Andrew's recommendation in regard to ex-standard scholars. (3) That teachers of sewing should content themselves with aiming at the same standard of efficiency as in the other subjects of the school curriculum.

The Scotch Inspectorate of Schools. It is understood that, following the recent appointment of an Assistant Professor of Latin to a vacancy in the Scotch Inspectorate of Schools, the sub-inspectors—twenty-six in number—addressed a memorial to Dr. Craik, Secretary of the Scotch Education Department, seriously protesting against the practice under which sub-inspectors do not in due time rise to the inspectorate as under the terms of their appointment they hold they are entitled to do. The reply which has been received to the memorial is not considered satisfactory. Further representations are to be made, and it is not improbable that the question will be raised in the House of Commons.

Assistant Teachers' Congress at Dundee. Arrangements are being made for the holding of a Congress of the Assistant Teachers' Association of Scotland in Dundee during the month of March. The business meetings will be held in University College, and addresses are expected to be given by the President of the E.I.S., the Chairman of Dundee School Board, and others. One of the subjects to be discussed will be the advisableness of reducing the attendance at the evening schools from four to three evenings a week, as recommended by Mr. Dickson in his paper read at the Aberdeen Congress. The Lord Provost of Dundee will recognise the Congress by a reception in the Albert Galleries, and other meetings of a social kind will also be held.

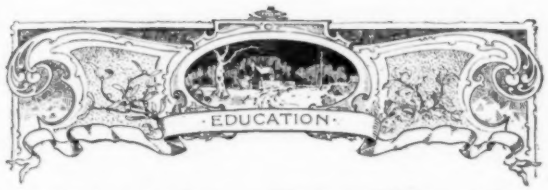
Unjust Dismissals. In accordance with the invitation of Lord Balfour of Burleigh, the Secretary for Scotland, that he should be furnished with a list of cases of alleged unjust dismissal during the past ten years, the General Secretary of the E.I.S. has issued a circular to local secretaries calling upon them to forward to him the particulars of any cases that may have occurred in their various districts. In addition to actual dismissals, information is requested regarding cases of threatened dismissal or resignation through fear of dismissal.

The Acharacle Dismissal Case. Mr. A. R. Forrest, Teacher, Acharacle, Ardnamurchan, and J.P., has been dismissed by his Board after ten years' faithful and efficient service, on the ground that he is not qualified to teach Gaelic. A petition, signed by five-sixths of the parents, praying for the suspension of proceedings, was presented in favour of the teacher, but without effect. The Board admits that Mr. Forrest is a good teacher, and that his reports have always been satisfactory. The Emergency Committee of the E.I.S. and the Lorn Branch are doing all in their power to support the parents in their endeavour to have Mr. Forrest reinstated by the new Board shortly to be elected.

The Case for Manual Training. At the last meeting of the Edinburgh branch of the E.I.S., Mr. John Gunn, M.A., D.Sc., read a paper on 'The Case for Manual Training.' Dr. Gunn remarked, by way of definition, that manual training, or hand and eye training, meant the use of certain exercises which had for their aim the training of the hand in accuracy and dexterity of movement, always guided by the eye, and it further implied a special kind of intellectual training, and an ethical or moral training throughout. It was a mistake, he remarked, to regard the Kindergarten system as something which should stop at the age of seven or eight. Manual training, he held, was the logical outcome of Kindergarten work, and its object was to produce a perfect or complete man or woman, whose hands were under control of the brain. The interest in manual work would be the one powerful factor in getting the best type of brain activity; and hence, in order to really educate and develop the brain, and to get the best intellectual training, manual activity must be conjoined with brain work. He thought that the day's work in school should consist of three hours in all of book work, and two hours of handwork. There were, of course, difficulties in the way, but the real difficulty was the making up of their minds as to the value of training hand and eye.

The late Walter Scott Dalgleish, M.A., LL.D. The somewhat sudden death of the late Dr. Scott Dalgleish will be felt as a loss by many in educational circles in Edinburgh. A graduate (M.A.) of Edinburgh, he received some years ago the honorary LL.D. of St. Andrew's. In early life he conducted a private college, and he made his first appearance in the field of educational literature through his well-known series of books on English Composition, published by Messrs. Oliver and Boyd. For over twenty-five years he filled an important position on the literary staff of Messrs. T. Nelson and Sons. He was associated with the head of that firm in producing the original 'Royal Readers,' whose phenomenal success will be familiar to most of the readers of this journal. The secondary school books on which he was principally engaged in more recent years, such as 'Great Authors,' Shakespeare's Plays, 'Higher Grade English,' 'Lower Grade English,' and a number of school histories, are scarcely less widely known. Outside his editorial work, he contributed educational and general articles to many journals, among others the *Times*, the *Scotsman*, the *Nineteenth Century*, the *Fortnightly*, and the *British Quarterly*, and the magazine of the Royal Scottish Geographical Society. Of this society he was an active and enthusiastic member, and was unwearied in his efforts to make the recent Nansen meetings the distinguished success which they eventually became, although he was himself unable to share in them. In University matters Dr. Scott Dalgleish took an active interest, and did much to guide the opinion of the General Council of his *alma mater* during the progress of the changes initiated by the University Commissioners. He was also one of the originators of the University Local Examinations, which did much to organise the course of study in secondary schools in Scotland. Of his connection with societies and clubs of a less directly educational character, such as the Pen and Pencil Club, the Literary Institute, and others, we cannot here speak, but there are many such in Edinburgh where the active figure and genial personality of Dr. Scott Dalgleish will leave a blank not easily filled.

Our Tutorial Section.



OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Head Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of 'Scholarship School Management.'

PUPIL TEACHERS' COURSE.

1. FOR APRIL 1897.—ELEVENTH MONTH.

WORK TO BE PREPARED.

A.—*English.*

(Students are invited to write for assistance in cases of doubt or difficulty.)

First Year.

Revise verses 21–30 of the 'Elegy' and suffixes generally.

Second Year.

1. Tabulate prefixes in lines 150–250 of 'Winter Evening.'
2. Revise lines 1–194 of 'Winter Evening.'

Third Year.

1. Learn 20 roots and meanings each week.
2. *Julius Cæsar.*—Revise Acts I. and II. Pay special attention to derivations, peculiarities in grammar, notes, and references.

Notes:—

1. General paraphrase of the 'Winter Evening' (lines 194–310).

If winter is spent in this manner it ceases to be unattractive, and we do not need the ranting tragedy in the unhealthy and vitiated atmosphere of a theatre to excite our emotions, nor the scrappy and empty chatter which passes with worldlings as wit, to raise our laughter.

When the self-satisfied actor takes a sly glance at his audience to estimate the probable profits which will accrue to him, he sees rising in tier upon tier a crowd of faces all convulsed with laughter, as though they were moved by some invisible spring, but not one of them exhibits so refined and pure a joy as that we enjoy at home.

We have no desire for cards and all the other inventions which have been devised to help time to pass quickly with those who have no mind or thought. Time with us passes by quietly, pleasantly, and gently. But how shall we picture him as representing the idea of fashionable society? The old man, with his white wings, hour-glass, and scythe, is sadly changed. The white feathers are tipped with colours; and as the eyes in a peacock's tail, so on his feathers we see the red diamonds, the hearts suggestive of bloodshed, clubs of disputes and quarrels, and spades which are emblematical of early graves. The hour-glass is changed into a dice-box, and the scythe is replaced by a billiard cue, which is equally effective in destruction of lives.

In this guise he is welcomed by the fashionable world, who are entirely ignorant of his true worth, and who are most pleased when they are doing nothing, and who seem to derive most happiness from the time that is irretrievably lost. Even girls, whose mothers at their age were still in children's dress, now dress like women, and seated in some favourable position intently watch the game till they are proficient in every trick and turn.

But I must cease this blame. If I allow myself to be drawn from my subject I shall never complete my task. As many a traveller is tempted from his path by some rock or ruin which appears to be of interest, but on closer inspection proves to be utterly worthless, yet which he carefully describes when he returns, to show the world how far he went to see nothing: so I, who started upon an inviting subject, am wandering into discussions of cards, dolls, and other things equally worthless.

And so I turn to welcome Evening, the season of peace and quiet: may she come soon and stay long. I picture her in the darkening west, moving forward with a steady and matronly step, while Night is following close behind. One of her hands is outstretched bestowing rest on bird and beast, the other brings to man a sweet forgetfulness of the cares and worries of the garish day. She is not decked with a galaxy of stars like gloomy Night—one or two twinkling over her head is sufficient; and if the moon adds its charm to her presence, it is not worn ostentatiously on high, but low down, with less brilliancy perhaps, but seemingly of a larger size.

When Evening comes she will find me a calm worshipper, or if perturbed by cares, these will soon be banished. Her chief charm is the power of easing care and trouble, and she is always welcome to me, whether I spend the period of her stay in reading, in music, or in writing poetry, or winding silk on ivory reels for the ladies, who are the natural rulers of mankind.

My pleasures begin when the drawing-room is illuminated with lights, which are reflected again and again from mirrors so large that Goliath might have viewed the whole of himself, from feet to towering crest, without stooping. Yet, perhaps, I equally enjoy an hour by the fireside before the lamps are lit, when the flickering flames throw strange shapes and shadows on the ceiling. The peculiar quiet of such twilight must be equally attractive to the mind which is devoted to earnest thought, and to the mind which is devoid of thought; to those deep in contemplation of some new work, and to those who are utterly indifferent to everything. Let those laugh who, endowed with robust strength and untiring energy, never require rest; I am not ashamed to confess that my mind often demands such relaxation. My fancy soothes me with day dreams of houses, castles, trees, or faces in the fire; or I watch with amusement the flapping of the sooty films on the bars, which in the eyes of the superstitious betoken the near advent of some stranger, an idea which countless failures will not eradicate.

The mind in such occupation may be said to sleep, the understanding to take its rest in mere emptiness of thought. This lazy existence is in many cases concealed by the face which indicates the greatest mental energy.

Reclining in my armchair I often pass an hour in such delightful glamour, till the howling of the wind outside recalls me to myself and shatters the brittle threads with which fancy has been enveloping me. The bitter cold and boisterous wind without only serve to enhance, by contrast, the peace and warmth within.

2. Selected lines from *Julius Cæsar.*

Act II., Scene 1. Brutus' soliloquy.

I see no other solution of the difficulty but by his assassination. As a private man I have no grievance against him, but I must consider the public welfare. He is anxious to become king, and it is very doubtful how that may affect his disposition. If we invest him with this new power, we put him in a position to do much harm. It is the warm day which brings forth the adder, and which thereby causes possible danger. If we crown Cæsar, we put a sting in him with which he may do much mischief. The worst of great power is that it often eclipses the quality of mercy which should accompany it, and I must say that I have never known Cæsar to allow his emotions to prevail over his judgment.

But it is a matter of common experience that those who are anxious to rise accomplish the first steps by the exercise of humility and deference to others whom they may desire to use; but when the desired position is attained, the means by which it has been reached is despised and forgotten, and the men look farther and farther ahead. This may be the case with Cæsar, and, therefore, in order to avoid such a position, we ought to preclude its possibility. And as we cannot justify our projected action from anything in Cæsar's character at present, we must put our case in this way:—That if we bestow on Cæsar this new dignity it may be productive of much harm to us all, and, therefore, to prevent this possible harm we had better take away the danger by killing him.

Brutus. Act II., Scene 1, line 61.

Since Cassius first biassed me against Cæsar, my mind has been in constant perturbation. Between the inception of some dreadful act and its successful completion, the interval passes like some hideous delusion or dream. The mind and the body are holding debate, the mind directing and advising that from which the body and its members shrink with disgust, and man is like some kingdom in rebellion, the physical frame refusing to do the bidding of the controlling mind.

Act III., Scene 1., line 58. Cæsar.

If I were of similar disposition to you I might be influenced; if I could bring myself to entreat and beg of others I might be moved by the same means; but I am fixed and determined. In the starry firmament there are thousands of stars apparently alike in all respects, but a careful examination reveals the fact that there is only one of them which is absolutely motionless. So in the world there are many men, outwardly alike and all capable of thought, and yet I know only one who, like the north star, is unmoved and unchanged by any influence, and that I am that man let me show by adhering to my opinion in this case. I thought it right that Cimber should be banished, and notwithstanding your entreaties I still maintain the same resolution.

Act IV., Scene 1. Antony's estimate of Lepidus.

Octavius, I have had more experience than you; and though it may be necessary at present to lay on this man some share of the honours and cares of state, we may consider him but as a beast of burden to carry for us what we like and where we direct, to move fast or slow at our discretion, from whom we may at any time remove his burden and turn him adrift. He may be a good soldier,

as you suggest, but he is on no higher level than my horse, who because of his utility I carefully look after, feed, and protect; whose bodily motions are controlled by my mind, and whose use depends entirely upon my government. And Lepidus must be treated in similar manner. He is a man without originality, incapable of the inception of any new scheme; one who appropriates to himself the odds and ends of old ideas which older men have promulgated, and then cast aside as of no further use. We can entirely neglect any influence which he may attempt to exert.

B.—*Arithmetic.*

First Year.

Boys.—Lock. Exs. XCVI. and XCVII. (Miscellaneous Exercises on Fractions and Approximations).

Girls.—Dixon and Beach. Ex. XXXVIII.

Second Year.

Boys.—Lock. Exs. CXXXIV–CXXXVI. Stocks.

Girls.—Dixon and Beach. Exs. XXV.–XXVIII.

Third Year.

Boys.—Work any collections of problems.

Girls.—Dixon and Beach. Exs. XXXVI.–XXXVIII.

C.—*Music.*

Continue working of any back questions.

D.—*Spelling.*

Fifty words per week from 'Words Commonly Misspelt,' or any good list.

E.—*Geography.*

New Zealand and Polynesia, and read up answers to questions below.

F.—*History.*

Revise George I., George II., and George III., and read up answers to questions below.

G.—*Euclid.*

Second Year.—Revise Book I., Propositions 12–18, and work four deductions per week.

Third Year.—Revise Book I., Propositions 31–40, and work four deductions per week.

H.—*Algebra.*

Third Year.—'Scholarship Algebra,' Chapter XXVIII. Square Root. *Mensuration* of rectangles and parallelograms.

I.—*Teaching.*

Second Year.—'Scholarship School Management.' Revise the Teaching of Writing.

Third Year.—'Scholarship School Management.' Revise Chapters IV., V., and VI. (Make sure of answer to all questions at end of book.)

TEST QUESTIONS.

1. *Penmanship.*

Largehand—Appreciating.
Smallhand—Lowliness is young ambition's ladder.

2. *English.*

FIRST YEAR.

1. Give in your own words the substance of the Elegy.
2. Quote any verses which you think particularly striking, and give your reasons.
3. How would you classify adjectives or adverbs? Take your examples from the poem.
4. Mention ten of the suffixes most commonly used. Illustrate by words from the elegy.

SECOND YEAR.

1. Give, in your own words, Cowper's description of Evening, or Winter, or Time.
2. What does he refer to in the following: 'Is India free,' 'æthereal journeys,' 'a Roman meal,' 'the tragic fur,' 'card-devoted Time,' 'he of Gath,' 'weedy fallows.'
3. Explain clearly Extension of Predicate, Indirect Object, Nominative of Address, Apostrophe, quoting examples from the poem you have studied.
4. What other poems did Cowper write? Give an account of one of them. Can you mention any famous men who were Cowper's contemporaries?

THIRD YEAR.

1. Write a character of Brutus, Cassius, or Octavius.
2. What do you know of the origin and date of the play?
3. Give instances of peculiarities in the grammar of the play, and mention any words in it you can which are now either obsolete or have changed in their meaning.
4. It is often stated that Shakespeare has purposely depreciated the character of Cæsar. Discuss this question.
5. Write a life of Shakespeare, and mention as many of his works as you can.

3. *Geography.*—AFRICA.

1. How is Cape Colony governed? Is it well suited for agriculture? What minerals are found? Describe its climate.
2. Mention some African explorers, and what they discovered. What were the chief difficulties met with?
3. What European countries have possessions in Africa? Enumerate them.
4. Describe the mountain and river systems of Africa.
5. Describe basin of Nile, Congo, Niger, or Zambesi.
6. Give the situation of Kong Mountains, Little Atlas, Mount Kenia, River Benin, Mauritius, Socotra, Victoria Falls, and the Blue Nile.
7. What districts are noted for gold, diamonds, palm oil, copper, date palm, gorillas, antelopes, white ants, and salt?
8. Where do the following races live, and to what stock do they belong?—Kaffirs, Berbers, Hottentots, Arabs, Gallas, Boers.
9. Arrange the states of N. Africa according to—1) area, (2) population, (3) importance.
10. Say what you can of Algeria.
11. What are the chief exports and imports of the Barbary States? Mention ports.
12. Explain fertility of Egypt. What are the chief crops?
13. What do you know of Tangier, Constantine, Kairwan, Siout, Wady Halfa, Suakim, Khartoum, Alexandria, Algiers, Fez, Tripoli?
14. Explain the terms—Tell, Bey, Khedive, fellaheen, oases, alfa, sphere of influence.
15. Give the boundaries of the Soudan. Account for its fertility.
16. Enumerate and briefly describe the chief states of Central Africa.
17. What are the two great waterways of Western Africa, and what merchandise passes up and down them?
18. What do you know of Freetown, Port Louis, Loanda, Leopoldville, Rabba, Stanley Falls, Timbuctoo?
19. Name the British Colonies, Protectorates, and spheres of influence in Africa.
20. What are the Karroos, and what industries are connected with them?
21. What are the most common plants, animals, and minerals of Cape Colony?
22. What do you know of Kimberley, Ookiep, Grahamstown, East London, Mashonaland, Walfisch Bay, Pretoria, Bloemfontein, Blantyre, Pietermaritzburg?
23. Describe situation and products of the Transvaal.
24. Give a short history of the British South Africa Company.
25. Describe situation, surface, and people of Abyssinia.
26. Say what you can of the islands round Africa.
27. What are, and for what noted, Lorenzo Marquez, Beira, Zanzibar, Ascension, Teneriffe, Bourbon, Comoro Islands, Massowah, Dembea, Tchad, Quilimane, Mombasa?
28. What do you know of the North Coast of Africa and its principal harbours?
29. Describe a journey from Cape Town to Buluwayo.
30. Say what you can of the Soudan and the Sahara.
31. Tell what you know of the productions, climate, government, and people of Madagascar.
32. Give some account of the areas of continental drainage in Africa.
33. 'The rivers as well as the lakes of Africa are most unequally distributed over the continent; most of them have rapids and cataracts in their middle course, a very short and ill-developed lower course, and dangerous sandbanks at their mouths.' Prove the above statements by a description of three of its rivers and three of its lakes.
34. Write a description of the lake system of Equatorial Africa.
35. What do you know of the Congo Free State and British East Africa?
36. Say clearly where the following lie—Pondoland, Basutoland, Swaziland, Bechuanaland, and Griqualand West.
37. What are the advantages and disadvantages of the Cape as a field for emigration?
38. Write what you know about the Red Sea as to its situation, extent, character of surrounding country, trade and ports.

NORTH AMERICA.

39. Give an account of a voyage to Canada, and say all you know about Nova Scotia.
40. Describe the basin of the St. Lawrence.
41. Name the chief physical features, industries, and exports of Manitoba and British Columbia.
42. Describe the route of the Canadian Pacific Railway, and show how it shortens the way from England to Australia.
43. What do you mean by the Dominion of Canada, how is it governed, and how did we come to possess it?
44. Describe the climate and productions of British North America.
45. Say what you can of Ottawa, St. John's, St. John, New Westminster, Winnipeg, Baffin Bay, Mt. Hooker, Labrador.
46. Explain how the United States are governed.
47. Give some description of the Mackenzie and Fraser Rivers, showing how and why they differ.
48. Describe the physical features of the United States.
49. Describe a coasting voyage from Boston to New Orleans.
50. Describe, with a sketch map, the basin of the Mississippi.
51. What are the chief productions, imports, and exports of the United States?
52. Name the races most numerous in the United States, and show how they are distributed.
53. What do you know of the resources of British Columbia?
54. Name some of the great railways and waterways of the United States.
55. Where and what are New York, Chicago, San Francisco, St. Paul, Denver, Cincinnati, Boston, Washington, Brooklyn, Buffalo, St. Louis, Kansas City, Sierra Nevada, Colorado, Prairies, Long Island, Hudson River?
56. Name the states of Central America, and say what you can of their people, towns, and government.
57. Name animal, vegetable, and mineral productions of Mexico.
58. Give some account of British Honduras, stating position, size, products, climate, and chief town.
59. Where and what are Yucatan, Nicaragua, Popocatepetl, Vera Cruz, Truxillo, Havana, Guatemala, Mexico City, San Domingo, Kingston, Greytown, Bahamas, and Trinidad?

4. *History.*

1. State the main objects of William III.'s foreign policy.
2. Mention the chief Acts passed in the reign of William III., with dates.
3. Give, in order, with dates, the chief events in the reign of William III.
4. Describe briefly the work of Parliament in William III.'s reign.
5. What were the chief results of the 'Glorious Revolution'?
6. Discuss the personal character of William III.
7. What were the results of Marlborough's victories?
8. Name three of the most famous writers and three of the chief statesmen in Anne's reign.
9. Say what you can about the 'Act of Settlement.'
10. Sketch the life of Marlborough.
11. Give dates for, and describe one of—Battle of the Boyne, Act of Settlement, Battle of Blenheim, Battle of Ramillies, Treaty of Utrecht, Capture of Gibraltar, Union of England and Scotland, Massacre of Glencoe, Peace of Ryswick.

12. When did the House of Hanover come to the throne? Show the names and relationship of all our sovereigns of that house, with their dates.
13. When were the Triennial and Septennial Acts passed? Discuss advantages of latter.
14. Write lives of Shrewsbury, William Penn, Addison, Marlborough.
15. Brief description of South Sea Bubble and the action of Walpole.
16. Write life of Bolingbroke, Ormonde, or the Old Pretender.
17. Lives of George I. and his consort.
18. Say what you can of the Porteous Riot, Young Pretender, the 'Forty Five.'
19. Name chief events in the reign of George II., and say what made the last year of that reign specially memorable.
20. What events occurred in India during the Seven Years War?
21. Narrate the particulars of the Black Hole Tragedy.
22. Short lives of Queen Caroline, Clive, Charles James Fox.
23. What additions were made to our dependencies and colonies in the 18th century?
24. Explain Queen Anne's Bounty, Whig, Habeas Corpus: give origin of the terms.
25. Mention the chief events in the Seven Years War, with dates.
26. Say what you can of Irish affairs in the reign of George II.
27. What led to the war of the Austrian Succession? How did it end?
28. What great naval battles were fought between 1793 and 1802?
29. How did the European wars affect England's social condition in the reign of George III.?
30. What induced our American colonies to assert their independence, and by what means did they secure it?
31. Give in order, with dates, the chief events from 1800 to 1820.
32. When where the legislative unions with England of Scotland and of Ireland effected? What led to the unions, and how were they accomplished?
33. When and how did the colonial empire of England begin? Mention three battles the results of which were a great increase in empire.
34. What were Nelson's three most important victories? Give dates, and describe one.
35. What were the causes of the French Revolution?
36. What produced war between England and America in 1812? How did the war end?
37. What made the following places famous? Plassey, Glencoe, Dettingen, Quatre Bras, Londonderry, Sedgemoor.
38. What occurred in 1763, 1776, 1797, 1798, 1800, 1805, 1809, 1815, 1820?
39. Write a life of Nelson or Warren Hastings.
40. Write a short account of Clive's exploits in India.
41. What were the immediate effects of the war which ended in Waterloo?
42. Describe the events which led up to the Battle of Waterloo.
43. What great Acts were passed in the reign of William IV.? Give a sketch of their main provisions.
44. Write a life of Walpole or Pitt.
45. Compare the English dominions in 1715 and 1815, and account for the difference.
46. Give a short account of the reign of George IV.
47. What do you know of the slave trade and its abolition?
48. Write a life of Wellington.
49. What do you know of Dunkirk, La Hogue, Culloden, Corunna, Ramillies, Torres Vedras, Camperdown, Cape St. Vincent, Vinegar Hill, Lexington?
50. What Acts have been passed against Roman Catholics and Nonconformists, and when and why were they repealed?

Answers to Mathematical Questions in Exam.

First Year.—Arithmetic.

Girls.—(1) The text book; (2) 37 min. 24 sec. after midnight; (3) £930,139 11s. 7½d.; (4) £8 12s. 2¼d.

Boys.—(2) 8$\frac{11}{12}$d., $\frac{1}{8}$; (3) ·369140625; 1 ft. 1·2890625 in.; (4) ·4.

Second Year.—Arithmetic.

Girls.—(1) ·16, ·769230; (2) 4$\frac{3}{10}$; (3) 3$\frac{44}{117}$; (4) 17 tons.

Boys.—(1) £1,966 13s. 4d.; (2) £59 17s. 11d.; (3) £8,629 1s. 9$\frac{9}{11}$d.; (4) 9$\frac{88}{89}$.

Third Year.—Arithmetic.

Girls.—(1) ·54, 3; (2) ·5; (3) £644 15s.; (4) 180 lbs.

Boys.—(1) ·226; (2) 7$\frac{1}{2}$; (3) 45 miles; (4) £3,219 16s. 10$\frac{1}{20}$d.

Algebra.

(1) $a^5 + 2a^4 - 8a^2 - 16a$.

(2) $17(a^2 + a - 4)$.

(3) $\frac{2}{p+3}$.

(4) 4; $-4\frac{1}{2}$.

OCTOBER EXAMINATION, 1897.

Sixth Month.

Work to be prepared.

A.—*English.*

(As the special books cannot be fully dealt with in these columns, students must write for assistance in cases of doubt or difficulty.)

First Year.

1. The Verb: Classification of Weak and Strong, Regular and Irregular, Transitive and Intransitive, etc. This must he carefully prepared. Learn definitions of Mood, Tense, Voice, etc.

2. Learn the Greek suffixes, with examples—not only the meaning of the suffix, but its use.

3. Prepare verses 21–24 of Gray's 'Elegy in a Country Churchyard.' Learn the meanings of all allusions, references, and the derivations of the chief words.

Second Year.

1. The Verb: Participles and Gerunds. These must be very carefully distinguished.

2. Anglo-Saxon Adjective prefixes, with examples.

3. Prepare lines 194–242 of the 'Winter Evening' (*Task*, Book IV.). Make sure of meanings, learn all notes, explanations of allusions, derivation of chief words. Be particularly careful with the paraphrasing.

Third Year.

1. Anglo-Saxon suffixes.

2. *Julius Cæsar.*—Prepare Act III., Scenes 2 and 3. Mark Antony's oration must be thoroughly mastered. Be prepared to analyse and paraphrase any part. Many of the sentences will require considerable thought.

B.—*Arithmetic.*

First Year.

Boys.—Lock. Work Example LVII. and LVIII. Reduction of one quantity to fraction of another.)

Girls.—Dixon and Beach. Read Chapter XI. and work Examples thereon.

Second Year.

Boys.—Lock. Work Example CXV. (Problems of Time and Work.)

Girls.—Dixon and Beach. Read Chapters XVIII., XIX. and work all Examples.

Third Year.

Boys.—Lock. Work Examples for Exercise Nos. 926–950.

Girls.—Dixon and Beach. Read Chapter XXVI. and work Examples.

(Too much stress cannot be laid upon the fact that the theory, arrangement, and method are of the highest importance. To work a sum accurately is not enough. It must be a model of lucidity.)

C.—*Music.*

First Year.—Whole-pulse notes, half-pulse notes, and continuations and corresponding rests.

Second Year.—Practise change of key and moduiation.

Third Year.—Learn one-fourth of musical terms in common use.

D.—*Spelling.*

Learn 50 words per week from 'Words Commonly Misspelt,' or any good list, and test frequently by Dictation.

E.—*Geography.*

British North America and the United States.—

Chief points:—

The meaning of the term 'Dominion of Canada,' the Provinces and Territories which comprise it—the chief industries and productions—the inland communications, railway and canal—the course of the Canadian Pacific Railway—some knowledge of the position, size, importance of: Quebec, Three Rivers, Montreal, Ottawa, London, Toronto, Hamilton, Kingston, Fredericktton, St. John, St. John's, Halifax, Sydney, Charlottetown, Port Arthur, Winnipeg, Brandon, Regina, Qu'appelle, Calgary, Dunvegan, Churchill, Fort York, Carlton, New Westminster, Vancouver, Victoria, etc.

Maps must be drawn and places inserted. Much information can be obtained from 'School Geography Readers,' and also from the pamphlets, handbooks, etc., which are given away by the various steamship companies, the Canadian Pacific Railway Company, and the agents for the colonies.

United States of America.—

The form of government, the various States, their leading characteristics, the industries, productions, etc. The Union Pacific Railway, the chief towns of the States, the Yellowstone National Park. Supplement Text Book by any general reading.

F.—*History.*

George III., 1793–1820.

This period is one which requires close attention. Events are somewhat complicated, and are liable to become confused unless care is taken to arrange them in note-books. The history of Napoleon's campaigns should be followed in so far as they immediately affect English History. Prepare lives of Nelson and Wellington and the Prime Minister Pitt. The policy of the English all through was to keep command of the seas, and to assist by men and money any European nation which was fighting against Napoleon. Note that the entire war added about £630,000,000 to the National Debt. The victories of Cape St. Vincent, Camperdown, Battle of the Baltic, Nile, and Trafalgar prevented Napoleon from crossing the Channel.

The Peninsular War.—Draw a large map of Spain and Portugal, enter all places mentioned, and trace the course which the various armies took. Napoleon's exile, the Hundred Days, and the Battle of Waterloo. Prepare a plan of the latter

The Irish Rebellion and the Union, the War with the United States, the Bombardment of Algiers. The distress at the end of the reign.

G.—*Euclid.*

Second Year.—Book I., Propositions 16–19, and four deductions per week.

Third Year.—Book I., Propositions 43–46, and four deductions per week.

II.—*Algebra.*

Third Year.—Chapters XII. and XIII. 'Scholarship Algebra,' H.C.F. Work by factors wherever possible. Learn the proof of the G.C.M.

I.—*Teaching.*

Second Year.—'Scholarship School Management,' Chapter V. The Teaching of Writing.

Third Year.—'Scholarship School Management,' Chapter XIII. (Discipline, Section 1 and 2.)

QUESTIONS TO BE ANSWERED.

1. *Penmanship.*—Write as specimens of—

(*a*) Largehand: Nylephtha, Ornithorynchus, Parallelogram, Questionably.

(*b*) Smallhand:

'Though the mills of God grind slowly
Yet they grind exceeding small.'

(Take a few minutes' practice each day at this exercise, writing from a good model.)

2. Write an essay each week, selecting from:—

Castles in the Air—The Lake District—The Canadian Pacific Railway—Canada as a Field for Emigration—Reason in Animals—Liberty of the Press—and Wild Flowers.

3. Notes of Lessons. (A criticism lesson must be given each week.) First Year P.T.'s should write outlines, all others full notes.

Autumn Leaves—A Plaice—Ice and Snow—Bricks—First Lesson in Simple Interest—British South Africa—A Thermometer—Distillation of Water—Cotton.

4. *First Year.*

(1) Analyse verse 12 and parse *yet, even, these, to protect, still, erected, decked.*

(2) Analyse verse 22 and parse *years, spelt, muse, many a, round, moralist to die.*

(3) Analyse verse 23 and parse *For, prey, being, even, wonted.*

(4) Analyse verse 24 and parse *For thee, mindful, Dost, If, chance, led, some.*

(5) Give the meaning of the suffix in the following words:—*memorial, shapeless, moralist, Forgetfulness, anxious, mindful, artless, lonely, Contemplation.*

Second Year.

(1) Paraphrase lines 200–210; 213–222; 226–231; 231–242.

(2) Analyse lines 200–206 and parse *when, stealing, slope, as it*, and line 206.
,, ,, 207–212 and parse *were, ever, yet, to fill, time unsoiled.*
,, ,, 220–224 and parse *what, dicebox, thus, decked*, and line 224.
,, ,, 232–242 and parse *which seen, coming home, what was nothing worth.*

(3) Give the meaning of root, prefix, and affix in the following:—*Unsavoury, dialogue, complacent, superfluous, quadrangular, destructive, excursive.*

Third Year.

(1) Paraphrase Act III., Scene 2.
(*a*) Here comes his body . . . death,
(*b*) You all did see . . . .
. . . . . to mourn for him.
(*c*) Oh, what a fall was there . . . .
. . . . traitors,
(*d*) For I have neither wit . . . .
. . . . rise and mutiny.

(2) Analyse the same passages.

(3) Parse:—
(*a*) I do entreat you not a man depart save I alone.
(*b*) I rather choose to wrong the dead.
(*c*) As rushing out of doors to be resolved
If Brutus so unkindly knocked, or no.
(*d*) Most unkindest cut.
(*e*) You'll bear me a bang for that.

5. Give an account of the river system of North America.

6. Enumerate the chief vegetable productions of North America.

7. Explain clearly the causes which led to the American War of Independence.

8. How was the French Revolution brought about? Trace the causes which led to it.

9. *Second Year.*
How would you endeavour to secure distinct articulation in the reading of your class?

10. *Third Year.*
What effect has the personality of the teacher upon the class?

11. Give some account of Nansen's recent explorations.

12. What general subjects do you think Pupil Teachers ought to study in addition to their ordinary work?

SCHOLARSHIP COURSE FOR DECEMBER 1897.

3RD MONTH—MARCH 1897.

1. *Reading.* } Ten minutes' practice daily. For Reading read
2. *Writing.* } Washington Irving's 'Sketch Book.'

3. *Spelling.*—50 words per week from 'Words Commonly Misspelt.'

4. *Composition.*—Write one or two essays each week, selecting from the following:—

War: Is it ever justifiable?—Industry of the British Nation—Mountain and lowland scenery—Fairy tales—Thrift—The study of Natural History.

(Read up all you can about the subjects, and draft a skeleton outline of the Essay before commencing to write it.)

5. *English.*—
(*a*) The Pronoun, fully.
(*b*) 25 Roots and meanings per week.
(*c*) Literature. Meiklejohn, Chapter III.

6. *Arithmetic.*—Decimal Fractions.

Learn proof of rule for converting Pure and Mixed Repeaters to Vulgar Fractions. The Addition, Subtraction, Multiplication and Division of Recurring Decimals.

Girls.—Algebra. Blackie's Elementary. Addition.

7. *Algebra.*—Hall & Knight, Exercises XIII*b*. to XV*c*.

8. *Euclid.*—Book I. Props. 18–24. Egan's Exercises, 40–60.

9. *Geography.*
(*a*) Revise Spain, Portugal, Italy, and the Balkan Peninsula.
(*b*) Australia. Physical features, climate, and productions.

Chief points.—Note regular coast unbroken by any large opening, mountains generally round the coast, and the results—a well-watered strip along the coast with numerous small rivers, a comparatively dry interior, shallow salt lakes, barren land unfit for habitation.

Difficulties to explorers:—(*a*) The mountain barriers; (*b*) The absence of navigable rivers or arms of the seas; (*c*) The absence of fresh water; (*d*) The impenetrable character of the dense bush; (*e*) The hostility of the natives; (*f*) The intense heat; (*g*) The absence of all natural foods; (*h*) The difficulties of transport: horses, donkeys, and mules useless; camels only mode of conveying supplies.

The Great Barrier Reef, over a thousand miles long, sixty to one hundred and twenty miles from the coast.

Productions (Vegetable).—Note the remarkable absence of all natural foodstuff plants; the enormous forests of eucalypti; the blue, red, white, and stringy bark gum trees, some of them over 400 feet high—one found towering 120 feet higher than the top of St. Paul's; the splendid jarrah wood; the flame tree; the gigantic ferns: the peculiar arrangement of the leaves.

The wonderful growth of plants which have been introduced should be noted. Thistles growing 16 feet high; watercress, etc. The apricots in Queensland, Tasmanian apples, etc. The enormous crops of wheat, maize, oats, and barley; the coffee, sugar, and oranges of Queensland.

Animals.—The native fauna distinctly peculiar; no large quadrupeds; many varieties of the marsupials, or pouched animals. Note dingo or wild dog, platypus or duck-billed watermole. Birds:—Emu, laughing jackass, bower bird, lyre bird, pigeons, etc. Many poisonous snakes.

Imported animals have done well. Sheep (of which there were nearly 100 millions in 1894), cattle, pigs, and horses numerous in all parts.

Minerals.—Very important; valuable deposits everywhere. Tabulate in note-book and learn places where found. Note the new Coolgardie District of West Australia.

NEW SOUTH WALES received its name from its first explorer, Capt. Cook, 1770. Became a penal settlement in January 1788. Capt. Phillip landed 750 persons on the site of the present town of Sydney. Responsible Government was established 1856, and vested in a Governor appointed by the Crown—a Legislative Council of 69 members and a Legislative Assembly of 125 members paid £300 per annum—manhood suffrage. Population, 1,251,420.

Productions:—

Animal—At the end of 1894 there were ½ million horses, 2½ million cattle, 57 million sheep, ¾ million pigs. 361 million pounds of wool, worth £9,000,000, were produced.

Mineral—Gold (amount for 1894 = £41,000,000), coals, copper, silver, tin, iron, antimony, asbestos, cinnabar, kerosene shale, small quantities of diamonds, rubies, opals.

Vegetable—Wheat, maize, and other grains, tobacco, sugar cane, wine, oranges, and every kind of fruit.

Exports—£20,000,000 per annum.
Imports.—£15,000,000.
Towns:—

Sydney.—Capital, on Port Jackson, pop. 423,000. Contains Government Buildings, Mint, University, National Art Gallery, Free Public Library, Observatory, two Cathedrals, etc.

Newcastle (13,500), Broken Hill (19,102; famous silver mines), Bathurst (10,000), Goulbourn (12,000), Paramatta (12,030), Maitland (10,000), Grafton, Albury, and Tamworth.

Dependencies.—Norfolk Island, pop. 750.
Lord Howe Island, pop. 50.

VICTORIA, originally part of N. S. Wales (known as Port Phillip District), made a separate colony in 1851. One of the youngest, the smallest, most populous, and most wealthy colony.

Area, 87,884 sq. miles. Population (1895), 1,180,043.

Productions :—
Gold, £238,000,000 since 1851.
Tin, copper, antimony.

Chief Exports in 1894—Wool (£4,742,000), gold (£3,700,000), wheat, flour, and biscuits (£961,000), livestock (£282,000), preserved and frozen meats (£170,000), butter (£898,000), wine.

Chief Imports.—Sugar, molasses, woollen goods, timber, and manufactured goods.

Towns :—
Melbourne.—Chief city; University, Museum, Mint, Public Gardens, Observatory, Public Library, Hospitals. Population, 438,055.
Ballarat, Bendigo (Sandhurst), Geelong, Castlemaine, Warrnambool, and Stawell.

Government:
(*a*) Governor appointed by Crown, and Executive Ministry of 10.
(*b*) Legislative Council of 48.
(*c*) Legislative Assembly of 84.

(Prepare a good map; insert all physical features and names of places to be remembered.)

10. *History*.

EDWARD I. TO RICHARD II.

Edward's Legal Reforms.
1275.—*First Statute of Westminster*.
Ratification of former statutes, provision for freedom of election.
1278.—*Quo Warranto Inquest*.
Enquiring by what warrant lands were held.
1279.—*Statute of Mortmain*.
Forbidding the alienation of lands to religious houses, by which the King lost feudal incidents.
1284.—*Statute of Wales*.
English law of inheritance, and English Criminal Law introduced into Wales.
1285.—*Statute of Westminster (and)*.
Defining the law of entail.
Statute of Winchester.
Robbers and felons to be followed from town to town and county to county.
Police Regulations.—Gates of towns to be closed from sunset to sunrise; highways to be cleared for 200 feet on each side; each man to keep his arms in readiness.
1290.—*Quia Emptores*.
Facilitating transfer of land, but providing that the buyer should owe fealty to the same overlord as the seller.
1297.—*De Tallagio non concedendo*.
King not to take tallage without will and consent of the Parliament.

In Edwar I's reign also the Law Courts were reorganised. The following table, based on Green's history, should be noted and learnt :—

The King's Council.

Great Council called when necessary. → Modern Parliament.

Permanent Council. Curia Regis or Aula Regia.

- Court of Exchequer.
- King's Bench (1178).
- Court of Common Pleas (1215).
- Chancery and Equity (1215).
- Various Councils as—
  - (*a*) Star Chamber.
  - (*b*) Council of the North.
  - (*c*) Council of Wales.
  - (*d*) The modern Privy Council, which advises on Education, Ecclesiastical matters, Colonial Affairs, Indian Affairs.

Consolidated into Supreme Court of Judicature.

- Court of Appeal.
- High Court of Justice.
  - (*a*) Chancery.
  - (*b*) King's or Queen's Bench.
  - (*c*) Probate.

Edward III.—Chief points :—
1327-1330.—The rule of Isabella and Mortimer.
1329.—*Renewal of Scotch War*. Defeat of Scots at Halidon Hill.
1337.—*The Hundred Years' War*.
Causes :—(*a*) The support given by Philip VI. to David Bruce.
(*b*) The jealousy of French and English sailors.
(*c*) The attempt by Philip to seize Aquitaine.
(*d*) The support given by France to the Court of Flanders against the rising power of the *wool towns*. As England supplied Flanders with the raw material, the domination of France would have seriously affected the export of wool—the staple product.
(*e*) Edward's claim to the French Throne can hardly be taken seriously, since if the principle he asserted were recognised, *i.e.* that a woman could transmit right, there were many who stood before Edward. The claim was probably made to secure the adherence of doubtful vassals of France.
Events :—Crecy and Neville's Cross, 1346. Capcure of Calais, 1347. Poitiers, 1856. Treaty of Bretigny, 1360. Plans and details of Crecy and Poitiers must be learnt.
Results :—A historical enmity of France and England.
A continual alliance of French and Scots.

1349.—*The Black Death*, a species of Cholera.
Results :—(*a*) The population reduced one-half.
(*b*) The rate of labour wages doubled.
(*c*) The beginning of the system of 'letting' lands at a fixed rent.
(*d*) The Statutes of Labourers, 1349-1351.
(*e*) Great mortality among sheep.
1376.—The Good Parliament, the work of which was undone by John of Gaunt.
Important Statutes :—
1351.—*First Statute of Provisors* against the right of Popes to present aliens to English benefices.
1352.—*Statute of Treasons*. As the lands of persons convicted of treason reverted to the Kings, it was their interest to stretch the term as widely as possibly. This Statute limited it to certain defined acts, such as :—
1. Plotting the death of King, Queen, or Prince of Wales.
2. Levying war on the King.
3. Counterfeiting the Great Seal and forging money.
4. Killing Chancellor, Treasurer, or Judges while executing their duties.

1353.—*Premunire (First)* against foreign jurisdiction, generally.
Statute of Staples—appointment of staple towns to facilitate collection of revenue.
1365.—*Premunire (Second)* against the Papal power in particular.
Richard II.—
The misgovernment in the years of minority.
1381.—*The Peasant's Revolt*, caused by—
The effect of the Statutes of Labourers.
The revival of villenage.
The discontent at the conduct of French affairs.
The unjust poll tax.
The socialistic teaching of Wycliffe's 'Poor Preachers.'
(Note that it was general in England. Wat Tyler's best known because most successful.)
Results :—The general decay of villenage.
Harsh laws against the poor.
Religious reaction.
The Lords Appellant and the Merciless Parliament.
The absolute rule of the King and his subsequent downfall.
Statutes :—
1390.—*Provisors (Third)*.
1392.—*Premunire Facias* against the power of the Pope.
(Note.—This is one of the great acts leading up to the severance of the English Church from Rome.)

11. *Teaching*.—'Scholarship School Management,' Chapter III.
Teaching Aids and their proper use.

12. *Domestic Economy*.—Animal and Vegetable Foods, the relative values.
Beef, veal, mutton, lamb, pork, bacon, fish, poultry and game, milk, butter, cheese, eggs, margarine, vegetables and fruits.

13. *Music*.—'School Music Teacher,' Chapter III.

14. *French*.
The Adjective.
La Grammaire, next 3 pages.

TEST QUESTIONS.

1. Write as specimens of copysetting :—
(*a*) Largehand :—
Diagram, Evolutionary, Faithfully.
(*b*) Smallhand :—
'Ah! what avail the largest gifts of Heaven
When drooping health and spirits go amiss?'

2. Analyse the following passages, and parse the words in italics :—

(*a*) To whom replied King Arthur, faint and pale,
'Thou hast betrayed thy nature and thy name,
Not *rendering* true *answer, as beseemed*
Thy *fealty*, nor *like* a noble knight:
For surer sign had followed—either hand,
Or voice, or *else* a motion of the mere.
This is a shameful thing for men *to lie*;
Yet now I charge thee, *quickly* go again,
As thou art lief and dear, and *do* the thing
I bad thee.'

(*b*) *Her* slow full words sank through the silence *drear*
As thunder drops fall on a sleeping sea.
Sudden I heard a voice that cried 'Come here,
That I may look on thee!'
I, *turning*, saw, throned on a flowery rise,
One sitting on a crimson scarf unrolled,
A *queen* with swarthy cheeks and bold black eyes,
Brow-bound with burning gold.

(*c*) *Even such* is time, that takes in trust
Our youth, our joys, *our all* we have,
And pays us *but* with age and dust;
Who, in the dark and silent grave,
When we have wandered *all* our *ways*,
Shuts up the story of our days.
But from this earth, this grave, this dust,
The Lord shall raise me up, I trust.

3. Chaucer has been called the 'Poet's poet' and the 'Founder of our fair language.' What right has he to these titles?

4. (*a*) Simplify $\frac{2\frac{1}{5} \times 3\frac{3}{11}}{\frac{9}{7} \times 1\frac{1}{17}} \div \frac{1\frac{7}{8} \times 3\frac{1}{15}}{3\frac{4}{13} \times 1\frac{6}{17}}$. Ans. 1.

(*b*) Compare the fractions $\frac{1}{16}$, $\frac{33}{38}$, $\frac{2117}{2855}$, $\frac{31}{54}$, $\frac{11}{15}$, and find the product of the sum and difference of the greatest and least of them. Ans. $\frac{41601}{174000}$.

(*c*) Simplify $\dfrac{1 - \dfrac{1}{2 - \frac{1}{3}}}{3\left(1 + \dfrac{2}{3\frac{1}{2}}\right) - 4}$ Ans. $\frac{5}{56}$.

(*d*) Find the difference between

£2 17s. 6d. and £12 18s. 9d.

2 cwt. 2 qr. 10 lbs. and 12 cwt. 0 qr. 19 lbs.

Ans. $\frac{4}{423}$.

(*e*) What is meant by the reciprocal of a number? What fraction divided by its reciprocal gives a quotient of $1\frac{29}{32}$? Ans. $\frac{7}{8}$.

5. What are 'Monsoons'? How do they affect the climate of India?

6. Explain clearly how India is governed.

7. What native races are under our rule in India? What are their religions?

8. Give some account of the institution of the House of Commons.

9. What were the chief provisions of the Magna Charta? Mention any which have since been abolished.

10. How does the study of child nature promote efficiency in teaching?

11. What are the chief carbonaceous and nitrogenous compounds in the ordinary foods?

12. Write notes of a lesson on Leather, Mountains, Joan of Arc, or a Railway.

CORRESPONDENCE.

(*See December for Rules.*)

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to 'A. T. FLUX, 12, Lower Park Road, Belvedere, Kent.'

ANSWERS TO CORRESPONDENTS.

JOY.—A good lesson, 75/100. The edible birds' nests are found mainly in the East Indies and sent to China. Made from a glutinous fish spawn.

QUEEN'S SCHOLAR.—A very good lesson, 80/100.

PEDAGOGUE.—Essay 45/60.

NORSE.—Penmanship 40/60. Practice from a good model needed. Essay 45/60. English—'Will' should be parsed as auxiliary when it denotes simple future. 90/100. Arithmetic—Apparently correct, but lacking in neatness and style.

OPHELIA.—Penmanship 50/60. Too stiff in style; a little more freedom would be a great improvement.

TONE.—Music correct. The explanations of terms might with advantage be a little fuller. Writing 45/60; lacking in regularity and firmness. Teaching 8/10. Fuller explanation needed. The National Park is in the State of Wyoming, U.S.; twice size of Kent; set apart by Congress as a National Park for ever. Full of wonders, cañons, geysers, waterfalls, lakes, etc.

ANSWERED BY POST.—G.P. (Halifax); T.F., J.H., and W.H. (Walsall); C.M.M. (Spilsby); L.S. (Stafford); A.M. (Leyton); W.P. (Halifax); M.A.T. (Smallbridge); E.T., A.R., N.M., and T.W. (Carlisle); R.W. (Uttoxeter); M.D. (Millorne); F.M. (Portsea); A.H. (Witney); N.M.L. (Bury); M.S. (Hitchin); V.W. (Boosbeck); J.H. (Halifax); E.L. (St. Helen's); A.O. (Llandyssul); M.M.W. (Pontymister); A.S. (Wolverhampton); H.H., E.J.S. (Andover); R.C.H. (Spennymoor); D.J.J. (Llanelly); M.C. (Westminster); J.E.O'C. (Woking); E.T. (Penzance).

RESULT OF COMPETITION.—The papers submitted varied very much, from very good to the opposite. It is to be regretted that some P.T.'s do not sufficiently avail themselves of the assistance which is offered in connection with this Course, and which would eradicate many errors in method which are fatal to success.

The prize of **One Guinea** is awarded to Miss ANNIE MOXON, Girls' Department, Rockholt School, Leyton, who obtained 428 marks out of a possible 475.

OUR 1897 CERTIFICATE CLASS.

BY J. C. HOROBIN, M.A.,
Principal, Cavendish College, Cambridge.

The Examination for Certificates will commence on Monday, 12th July 1897, at 2 p.m.

The general conditions for candidates are to be found in Articles 55–64 and 116–121 of the current Code.

Notes on Logic.

Dichotomy is division into *two* classes.

Dichotomy by contradiction is the process of division on the basis of the possession or non-possession of a certain quality.

E.g.—Old books.
Not old books (new).

Each of the sub-classes can be again divided—

E.g.—Old books { English. / Not English (foreign).

Not old books { English. / Foreign.

A Name is a word (or phrase) which represents any *thing* having a peculiar quality or set of qualities.

If there be two classes of things such that the second may be regarded as separated from the first by peculiar qualities, the first class is called a GENUS with regard to the second, and the second a SPECIES with regard to the first, and its peculiar attribute is called its *differentia*.

E.g.—Towns (genus).
Towns lit with electricity (species).
Lit with electricity (differentia).

Definition is to give a thing such a name as will indicate the GENUS and the *differentia* of the species.

E.g.—Define triangle.
A closed FIGURE (genus) having *three sides* (differentia).

A Proposition in Normal form consists of four parts:—
(1) A sign of QUANTITY (*some*, *no*, or *all*).
(2) A name as SUBJECT.
(3) The COPULA (*is*, *are*).
(4) A name as PREDICATE.

Particular Propositions refer only to a *part* of the subject. The specific symbol is '*Some*.'

A Universal Proposition refers to every member of the subject. Universals are positive or negative according as they affirm or deny that every member of the subject is a member of the predicate.

The specific symbol is '*All*' or '*No*.'

A Proposition whose subject is an individual is regarded as universal.

There are two kinds of Propositions—
(*a*) Propositions of existence.
(*b*) ,, ,, relation.

In (*a*) the reality or imaginariness of the predicate is asserted.

E.g.—Some lawyers are honest men.

This assumes 'honest men' to be a reality.

E.g.—There are no horned men.

This asserts that the class horned men is imaginary.

In a Relational Proposition the terms are two species of the same genus, but each has an attribute not conveyed by the other.

Thus 'Some merchants are misers' is a correct example, as both merchants and misers are species of men.

But 'Some dogs are terriers' is not of the right kind, for though 'dogs' and 'terriers' are species of 'animals,' neither convey any idea of an attribute not conveyed by the other.

Many Relational Propositions are not expressed in proper form, and must be so expressed to bring them within the scope of formal logic.

E.g.—(1) 'Some apples are not ripe,'
in proper form is—
Some | apples | are | not ripe *fruit*. |
(2) 'None but the brave deserve the fair,'
becomes—
No | not brave *persons* | are | persons deserving of the fair. |
(3) Logic puzzles me,
becomes—
All | logical studies | are | things that puzzle me. |

A Relational Proposition beginning with 'Some' or 'All' implies that some existing things are members of both terms at once. Hence each term separately is real.

But if the proposition begins with 'No' it implies that no existing things are members of both terms at once, but it gives no information about the terms taken separately.

Examples for Practice :—

(A) Reduce to normal form :

No fat creatures run well.
You and I know what we're about.
Some bald people wear wigs.
Some apples are not ripe.

(B) 1. What is Science? What is Art? How does Logic stand related to these?

2. 'Singular terms have, at least directly, connotation.' Explain.

3. 'Species is part of genus, and genus is part of species.' Explain this statement.

4. Show that definition and division are both necessary to the complete understanding of the meaning of a common term.

5. In what sense is Logic concerned with the truth of propositions, and in what sense not?

Solutions.

(A) No | fat creatures | are | creatures that run well.
All | members of the class, 'You and I' | are | persons who know what they're about.
Some | bald persons | are | persons accustomed to wear wigs.
Some | existing things | are | not ripe apples.

(B) 1. 'Science is occupied in detecting and describing the natural laws which are inflexibly observed by the objects treated of in any branch of knowledge.'

Art frames rules for the practical application of the principles laid down by Science.

'Logic is a Science in so far as it investigates the necessary principles and forms of thought.' Logic is 'an Art when it is occupied with framing rules to assist persons in detecting false reasoning.'

2. A singular term is that which denotes only a single object. As such it serves only to distinguish that object from all others which belong to the same class, but it conveys in itself no other meaning; that is, it has no connotation. But indirectly it connotes everything which can be predicated of the class to which it belongs. Thus, whatever can be predicated of man generally can be predicated of the individual Beaconsfield.

3. Species is part of genus, inasmuch as genus is a class of things which is made up of smaller classes called its species. The species *man* is part of the genus *animal*.

Genus is part of species, inasmuch as species means the sum of the qualities common to all the individuals forming part of the genus, and therefore must contain all the qualities of the genus as well as certain additional quality or qualities by which the several species are distinguished from each other. Thus *man* contains all the qualities which are contained in *animal*, together with the quality of reason which distinguishes him from all other animals.

4. Definition refers the term defined to the class of things to which it belongs, and at the same time points out the difference which distinguishes it from all other members of that class.

Division points out the different groups or members which are contained in a class of things. It is only after we have divided the class to which we refer the thing defined that we can discover the particular head under which it comes. In defining *triangle*, we first refer it to the class *figure;* but before we can say what kind of figure it is we must divide figures into groups, according to the number of their sides, and then select the one *three-sided*.

5. Logic is concerned with the truth of propositions, so far as they are inferences, whether immediate or mediate, from other propositions. It is not concerned with the truth of propositions in themselves. Thus Logic cannot determine whether the proposition 'All Cretans are liars' is true or false. But if it be true, then it is true that 'some Cretans are liars.'

Questions for Tests.

First Year.

1. Write in large, half-text, and small hand :—

'Little strokes fell great oaks.'

2. Dictation :—

Whenever I approached a peasant's house | towards nightfall | I played | one of my most merry tunes, | and that procured me not only a lodging | but subsistence for the next day. | I once or twice | attempted to play for people of fashion, | but they always thought my performance odious, | and never rewarded me even with a trifle. | This was to me the most extraordinary | as whenever I used | in better days | to play for company | when playing was my amusement, | my music never failed to throw them into raptures, | and the ladies especially, | but, as it was now my only means | it was received with contempt, | a proof how ready the world is | to underrate those talents | by which a man is supported.

School Management.

1. Draw up concise directions to a P.T. on the matter and mode of Notes of Lessons.

2. What are the chief errors in Writing, and how would you deal with them?

3. What is meant by intuition and intuitive method of teaching?

Composition.

1. Habit.

2. A Teacher's Life.

3. Tennyson's aim in 'Lotos Eaters.'

Arithmetic.

1. Explain as to a class :—In what time will the simple interest on £650 amount to £130 at 5 per cent. per annum?

2. Find the times between three and four o'clock when the angle between the hands of a watch is one-third of a right angle.

3. Reduce to its simplest form :—

$$\frac{3\cdot05}{\cdot04275} \times \frac{\cdot342}{4\cdot216} \times \frac{1\cdot5318}{\cdot27}.$$

Music.

1. Write down the names of the tones of the common scale in the order they are taught on the Tonic Sol-fa method.

2. State the names of (1) the strong tones of the scale, (2) the leaning tones, (3) those tones that have the greatest leaning tendency.

3. Name (as major sixth, etc.) the following intervals :

f l r s t_1 l t_1 d d l

4. Write the following passage an octave higher :

d s_1 m t_1 r l_1 d s_1 f m r l_1 m r d

5. The following passage is given in five keys. Which will sound highest and which lowest?

Key F, **d t_1 r m d** Key D, **d t_1 r m d** Key E, **d t_1 r m d**
Key B, **d t_1 r m d** Key A, **d t_1 r m d**

6. In the major scale (1) which tone is mediant, (2) which supertonic, (3) which sub-dominant, (4) and which leading note?

English.

1. What do you know about :—

Quit rents—Lyon's Inn—a mask—tinsel—put—seven wonders—spring gardens—old fellow in whiskers—Hector's ghost.

2. What do you know of :—

Field of Asphodel—the stone—the wheel—Queen of death—nine bright moons—steam—fallow—hard Eternities—nectar—dark one—bright one.

3. Analyse and parse all the nouns and participles in the first paragraph in Chapter XI. (The Coverley Witch).

4. Similarly in the last two stanzas of 'A Dream, etc.'

Geography.

1. Write a summary description of Liberia, Wadai, Morocco, Abyssinia.

2. What do you know of the Semites and Hamites and the parts they inhabit?

3. Compare the Zambesi and Nile.

History.

1. Describe the condition of literature and science under the Stuarts. Name some of the chief men, with the work for which famous.

2. Describe the steps in the Revolution of 1688.

3. Describe Pitt's relation to the question of Catholic emancipation.

MEN ONLY.

Algebra.

1. Prove rule for multiplication of fractions. Show clearly that $a-b$, $b-c$, and $c-a$, cannot all three be positive or all three negative.
2. Define ratio, proportion, variation.
   If $c>d$, show that $(a+b+c-d)^2>(a+b-c+d)^2$.
3. Prove a quadratic equation cannot have more than two roots.
   Solve—
   (*a*) $\frac{x-2}{3}+\frac{4-x}{2x+1}+\frac{1-2x}{6}=0$.
   (*b*) $4x^2-x-14=0$.
   (*c*) $\sqrt{3x-8}+1=\sqrt{5x-11}$.

Geometry.

1. Prove III., 35.
   Construct a triangle having given base, vertical angle, and perpendicular to the base.
2. Prove II., 2.
   If from the vertical angle of a right-angled triangle a perpendicular be let fall on the hypotenuse, its square is equal to the rectangle contained by the segments of the hypotenuse.
3. Prove I., 48.
   Inscribe a square in a triangle having its base on a side of the triangle.

WOMEN ONLY.

Needlework.

1. Cut out and tack together the upper half of the back and front of a woman's chemise. (Right-hand side only.)

Domestic Economy.

1. Explain fully what is meant by 'breathing'; what is the use of it, and what is the structure of the organs concerned in it.
2. Show that mastication is in reality the first stage in the digestive process, and describe the second stage.

OR,

Geometry.

1. Prove I., 17.
   Prove this without producing a side.

SECOND YEAR.

Penmanship.
Dictation.
Composition.
Geography.
History.
Arithmetic.
Music.
As First Year.

School Management.

1. Criticise the following questions as introductory to collective lessons. Say whether you consider them skilful or unskilful, and why?
   (1) Why is coal growing scarcer? (2) What animal is most like a dog? (3) Is the tail of the bird in this picture long or short? (4) You are fond of flowers, are you not? What monarch reigned before Queen Elizabeth?
2. Discuss these sayings of Friedrich Froebel; and give them, if you can, a practical application to the work of an elementary teacher:—
   (*a*) 'In these games, I detected the main-spring of the moral strength that animated the pupils.'
   (*b*) 'Closely akin to the games in their morally strengthening aspect were the walks, . . . especially when conducted by Pestalozzi himself.'
3. How much time per week should be given to each of the elementary subjects, and to sewing, singing, geography, and English respectively, in a mixed school where instruction in music is given by note?
4. What limits does Fitch put to the usefulness of the Kindergarten? What has he to say about Locke and writing?

English.

1. Write an account of the incidents immediately preceding Arthur's death.
   Comment on:—
   I found Him . . . . . find Him not.
   lesser God . . . . . world.
   But that . . . . . to the close.
   I pass . . . . . not die.
   For why—reels—weird—Gawain—Holy Grail—isle of rest.
2. Comment on 'Shylock is a good hater,' with extracts to prove or not.
3. Give an analysis of the plot of *Macbeth*.
   Comment on:—
   God's soldier be he—prowess—baited—despair—intrenchant—bruited—kernes—staves.

MEN ONLY.

Algebra.

1. All of First Year.
2. (*a*) Find the condition that the roots of $Ax^2+2Bx+C=0$ should be equal.
   (*b*) If the roots of $(b-c)x^2+(c-a)x+(a-b)=0$ are equal, then a, b, c, are in A.P.
3. (*a*) Prove ${}_nC_r={}_nC_{n-r}$.
   (*b*) Expand $(3-x)^6$, and deduce from it the value of the integral part of the sixth root of $2\frac{1}{2}$.

Geometry.

1. All the First Year.
2. Prove IV., 12.
3. Prove VI., 1.
   Through a given point P draw a chord of a circle so that the intercept EF may subtend a given angle X.

WOMEN ONLY.

Needlework.

1. Cut out and tack together the right-hand side of the upper part of a woman's night-dress, setting in one sleeve.

Domestic Economy.

1. All First Year.
2. Explain the working and special advantages and disadvantages of:—
   (*a*) Benefit clubs.
   (*b*) Annuities.
   (*c*) Life assurance.
   (*d*) Co-operative societies.

OR,

1. Euclid, as First Year.
2. Prove I. 40.
   Triangles and parallelograms of equal bases and altitudes are respectively equal.

SYLLABUS OF WORK FOR THE MONTH.

Students are advised not only to get up the work indicated, but also to use the test questions as indications of work to be got up and afterwards written out.

FIRST YEAR.

School Management.

1. Qualifications necessary for teacher.
2. Questioning and answering.
3. Use and abuse of fairy stories.
4. Diagrams for proving rules in fractions.

Composition.

1. Times of Shakespeare.
2. Comparison of Tennyson and Addison.
3. Arthur.
4. Sir Roger.

Arithmetic.

Not less than six examples from miscellaneous sets ought to be worked per week, as well as those on the particular work set and the examination questions given.

1. Pars. 251–254, P.
   ,, 382–3, and examples on them.
2. Pars. 255–259, P.
   ,, 382–3, and examples on them.
3. Pars. 260–262, P.
   Revise 375–383.
4. Pars. 263–268, P.
   Revise 375–383.

Music.

1. Suitable exercises for Div. I.
2. ,, ,, Div. II.
3. ,, ,, Div. III.
4. Revise 1–3, and the mental effects of the notes used.

English.

1. Classification and inflection of adverbs.
2. Periods of English and their chief marks.
3. Prepositions and conjunctions.
4. English and Keltic elements in the language.

Literature.

1. Palace of Art.
   Addison as a Politician.
2. Coverley Love Match.
   Tennyson's metre.
3. Palace of Art.
   Addison as a man.
4. Coverley etiquette.
   Tennyson as a man.

Geography.

1. General sketch—relief—river systems—flora—fauna.
2. African races.
3. Exploration.
4. Political relations.

History.

1. Henry V.
   Napoleon—Washington.
2. Perceval Ministry and events under it.
   Warwick—Joan of Arc.
3. Henry VI.
   Wellington—Peel.
4. Liverpool Ministry and events under it.
   Cade—Lollards.

1. Grand Remonstrance.
   Montrose.
2. Five Members.
   Cromwell.
3. Civil War—Edgehill—Oxford—Marston Moor.
   Hampden.
4. New Model.
   Rupert.

MEN ONLY.

Algebra.

1. Proof of all rules in Fractions.
2. ,, ,, Progressions.
3. ,, rules for H.C.F. and L.C.M.
4. Relations of roots and coefficients in Q.E.

Geometry.

1. Book I. 1–5.
   ,, II. 5 and 12.
   ,, III. 27–29.
2. Book I. 6–10.
   ,, II. 6 and 13.
   ,, III. 30–32.
3. Book I. 11–15.
   ,, II. 7 and 14.
   ,, III. 33–35.
4. Book I. 16–20.
   ,, II. Revise 9 and 12.
   ,, III. 36–39.

WOMEN ONLY.

Needlework.

Sleeve of a chemise—stitching—feather stitching.

Domestic Economy.

1. Digestion and the organs concerned.
2. Servants and their duties.
3. Breathing and the organs concerned.
4. First Aid.

OR, *Geometry.*

Euclid. Revise Definitions.
,, Props. I. 1–5.

SECOND YEAR.

Composition., *Music.*, *Arithmetic.*, *Geography.*, *History.* — As First Year.

School Management.

1. First two weeks of First Year.
   Notes on Logic given.
2. Fitch I.
   Sense impressions—concept—perceiving.
3. Second two weeks of First Year.
   Notes on Logic given.
4. Fitch II.
   Association and its laws—examples of kinds—inaccurate observation—cause and cure.

English.

1. First two weeks of First Year Grammar.
   Deighton's Introduction to Idylls.
2. 'Merchant of Venice,' Act IV., Scene 1, line 127 to end.
   'Macbeth,' Act III., Scene 1.
3. Second two weeks of First Year Grammar.
   Deighton's General Introduction to Tennyson.
4. 'Merchant of Venice,' Act I., Scene 1.
   'Macbeth,' Act III., Scene 2.

MEN ONLY.

Algebra.

As First Year.
1. Binomial Theorem.
2. Proof of Rules, Permutations, and Combinations.
3. Binomial Theorem.
4. Examples in P. and C.

Geometry.

As First Year.
1. Book IV. Prop. 6.
   ,, VI. ,, 15.
2. ,, IV. ,, 7.
   ,, VI. ,, 16.
3. ,, IV. ,, 8.
   ,, VI. ,, 17.
4. ,, IV. ,, 9.
   ,, VI. ,, 18.

WOMEN ONLY.

Needlework.

As First Year.
Yoked muslin pinafore.

Domestic Economy.

As First Year.
1. Investments and Savings.
2. Household expenses.
3. Servants and their duties.
4. Revise 1–3.

Geometry OR,

Euclid as First Year.
Also Propositions 40–44.

QUERY COLUMN.

RULES.

1. **Each correspondent is restricted to *one* question.**
2. **Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.**
3. **Correspondents must in all cases state the source from which their query has been obtained.**

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

R.F.E.—Cloth being wetted shrinks up $\frac{1}{8}$th of its length, and $\frac{1}{16}$th of its width. If the surface of a piece of cloth is diminished by $5\frac{3}{4}$ yards, and the length of the four sides by $4\frac{1}{2}$ yards, find the length and width of the cloth.

Let x and y be the long and short sides respectively; then the area of surface before shrinking is xy, and the sum of the sides $2x + 2y$. After shrinking the sides become $\frac{7}{8}x$ and $\frac{15}{16}y$, and therefore the surface will be $\frac{7}{8}x \times \frac{15}{16}y$, while the sum of the sides will be $2(\frac{7}{8}x + \frac{15}{16}y)$. From the question, therefore, we have :—

$$xy = \tfrac{7}{8}x \times \tfrac{15}{16}y + 5\tfrac{3}{4}, \quad (1)$$

$$\text{and } 2(x+y) = 2(\tfrac{7}{8}x + \tfrac{15}{16}y) + 4\tfrac{1}{2}, \quad (2)$$

which on simplifying become :—

$$xy = 32. \quad (1) \qquad 2x + y = 34. \quad (2)$$

$$\therefore x(34 - 2x) = 32 \text{ ; or } 2x^2 - 34x + 32 = 0,$$

$$i.e.\ x^2 - 17x + 16 = 0 \text{ ; } \therefore (x - 16)(x - 1) = 0.$$

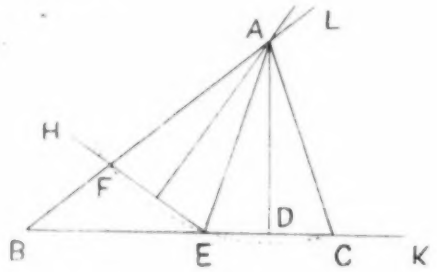
Hence $x = 16$, or 1, the latter of which is not admissible. The length is 16 yards, and therefore the width is 2 yards.

Marie.—AB is a given line, and AC is given in magnitude but not in direction. If the parallelogram ABCD be completed, then D will lie on a fixed circle.

With A as centre and AC as radius describe a circle. Take *any* point C on this circle, join AC, and complete the parallelo-

gram ABCD. Now imagine C to move on its circle and the parallelogram to be completed for every position of C. It will be obvious that D's path will be an exact copy of C's. This suggests drawing DA′ parallel to CA to meet BA produced in A′, which will be a fixed point, for A′A = DC = AB. Thus you will see that D moves on a circle with A′ as centre and AC as radius, for A′D = AC. You should now write out a solution in your own words.

E. G.—Given the vertical angle of a triangle, the difference of the sides containing it, and the difference of the segments of the base made by a perpendicular let fall upon it from the vertical angle. Construct the triangle.



[Observe at the outset that the accompanying figure is serving a double purpose; you will be instructed to make a separate figure yourself.] Assume that ABC is the required triangle. We must make a construction which will exhibit the differences referred to. For example, with A as centre, and AC as radius, describe the arc giving rise to E and F, then it will readily be seen that BE and BF are the given differences. We now ask you to draw BK, and on it set off the known length BE. Although BF is known in length, we do not know the angle FBE, but this information must be supplied by examining for any relations which may have arisen from the construction employed above. For example, the angles FAE and EAC are respectively double of FCE and EFC, from which it follows that the exterior angle BEF is half of BAC. Proceeding with your construction, make the angle BEH equal one-half of the given vertical angle BAC, and with B as centre, and the given length BF as radius, describe an arc cutting EH in F; join BF, and produce to L. Since A is the centre of a circle which passes through E and F, if you draw a line bisecting FE at right angles, it will intersect BL in A. Finally you may determine C by describing the arc with A as centre, passing through E, and meeting BK in C. We have given you an analysis of the problem; you will probably now be able to write out the solution in your own words.

Magister.—The term 'gain on £100' in the problem in question clearly stands for a *definite* sum of money, namely, the amount for which 10 bats are sold. If you change this into 'gain per cent.,' and then consider that this may mean the gain in *shillings* on 100 shillings, you clearly alter the sum for which the 10 bats are sold, and therefore alter the problem. You might equally regard it as meaning the gain in pence on 100 pence, in which case you would have made a different problem still—in fact, an impossible one. By saying gain on £100, the sum of money is definitely fixed.

Baccalao.—If $x^3 + ax^2 + bx + c$ be exactly divisible by $x^2 + px + q$, show that $p(p - a) = q + b$.

$$x^2 + px + q \;)\; x^3 + ax^2 + bx + c \;(x + a - p$$
$$x^3 + px^2 + qx$$
$$(a - p)x^2 + (b - q)x + c$$
$$(a - p)x^2 + p(a - p)x + q(a - p)$$

If there has to be no remainder, then clearly $b - q$ must equal $p(a - p)$, and also c must equal $q(a - p)$.

Libo.—The Simson line with respect to the point O bisects the join of O and the orthocentre of triangle ABC.

This is proved in Nixon's 'Euclid Revised,' Theorem 18, p. 169. A few of the preceding theorems are required; the solution is rather a long one.

Frances Best.—'AC is the diameter of a semicircle, on which a point B is taken, so that BC is equal to the radius, show that AB is a mean proportional between BC and the sum of BC, CA.'

We have to show that:—

$$BC : AB :: AB : BC + CA,$$
i.e., that $AB^2 = BC \cdot (BC + CA)$,
or $AB^2 = BC^2 + BC \cdot CA$,
or $AB^2 = BC^2 + 2BC^2$,
or $AB^2 = 3BC^2$.

This is evidently the case, because by I. 47—
$AB^2 = AC^2 - BC^2 = 4BC^2 - BC^2 = 3BC^2$.

Constance Lowe.—Apply to the Registrar of the Society at 1, Savile Row. Full particulars can be had gratis.

'*Discipulus*,' *Strait Settlements.*—'If the expressions $ax^3 + bx + c$, and $a + bx^2 + cx^3$, have a common quadratic factor, prove that $a^2 - ab - c^2 = 0$; and when this condition is satisfied, find the factors of the expressions.'—(Camb. Loc. Senior, 1890.)

Let the common quadratic factor be $px^2 + qx + r$. Take the first expression, and proceed to divide by the common factor; thus—

$$px^2 + qx + r \;)\; ax^3 + bx + c \;\left(\frac{ax}{p} - \frac{aq}{p^2}\right.$$
$$ax^3 + \frac{aqx^2}{p} + \frac{rax}{p}$$
$$-\frac{aqx^2}{p} + \left(b - \frac{ra}{p}\right)x + c$$
$$-\frac{aqx^2}{p} - \frac{aq^2}{p^2}x - \frac{aqr}{p^2}$$

Now since there is to be no remainder, we must have—

$$b - \frac{ra}{p} = -\frac{aq^2}{p^2} \quad (1); \text{ and } c = -\frac{aqr}{p^2} \quad (2).$$

Treating the other given expression in exactly the same manner, we get—

$$bq - \frac{cq^2}{p} = -rc \quad (3); \text{ and } \frac{br}{p} - \frac{qcr}{p^2} = a \quad (4).$$

Thus we have four equations, from which, if we eliminate p, q, and r, we shall obtain the desired relation between a, b, and c.

From (4) and (2), eliminating r, we get—

$$pb - qc = -\frac{a^2q}{c}. \quad (5)$$

From (3) and (1), we get, eliminating r,

$$pc + qa = 0. \quad (6)$$

From (6), $p = -\frac{qa}{c}$, which value, substituted in (5), gives—

$$\underline{a^2 - ab - c^2 = 0.}$$

To get the actual factors, we must now try to find p, q, and r.

Substitute the value of q from (6) into (3); this gives $p = r$; then, from (2), $q = -\frac{rc}{a}$.

Putting these values of p and q in the quotient and divisor of the first step, the factors in the first expression are easily found to be $\left(\frac{ax + c}{a}\right)(ax^2 - cx + a)$; similarly for the second expression.

H. G. P.—Inorganic Chemistry Text Books: Newth's is a very good book. If, however, you cannot get through it, try Reynold's, Parts I.–III.; or you might read Newth's for the Non-Metals, and Reynold's, Part III., for the Metals. In any case read Tilden's 'Chemical Philosophy,' which will not be heavy reading.

CIRCULAR TO TRAINING COLLEGES.

Circular 383.

Changes in Class List of Certificate Examination.

EDUCATION DEPARTMENT,
WHITEHALL, LONDON, S.W.,
6th February 1897.

SIR,

Since the issue of Circular 377 my Lords have had the advantage of conferring with representatives of several of the Training Colleges of both kinds, and have decided to adopt, for the present, the following plan in modification of that sketched in the Circular :—

1. A double Class List with a separate classification for Part I. and Part II. of the Examination will be issued. The Class List for Part I. (and that for Part II. also, where the Department's Examination is taken) will be arranged by the Department in three Divisions as at present.

2. Where an approved University Examination is taken in substitution for the subjects of Part II. of the Syllabus, the authorities of each College (Residential or Day) may classify those of their students who pass that examination in three Classes, on the basis either of such information as they can obtain from the University Examiners, or of the work done by the students at College Examinations in the subjects of their University Course. The Department will reserve the right of revising the classification above described.

3. Students whether in Residential or Day Training Colleges not taking an approved University Examination, if allowed by the Department to take a special programme of study in substitution for Part II., will be classified by the authorities of their respective Colleges in three Divisions according to the results of an Examination held by the authorities of the College in the subjects of the particular programme selected. In these cases the questions set at the Examination and the papers worked will be sent up to the Department as at present.

4. Students, whether in Residential or Day Colleges, failing in the University Examination substituted for Part II. will be judged by the results of an examination held by the College authorities either before the University Examination, or as soon after it as is feasible, in the subjects of that Examination. Their papers will be marked by the College authorities, who may propose a Class List based upon them, and the papers will then be submitted, with the questions set, to the Department. If the authorities of any College are unwilling to undertake the responsibility of classifying their students who have failed in their University Examination, my Lords will endeavour to hold a Special Examination in December for such students. This Examination will be in the subjects of Part II. of the Syllabus (except the Science Subjects), and 2nd year students who pass it will be recognised as Certificated Teachers from the 1st of July preceding.

5. The classification in Part II. when undertaken by the Department, will be determined by the following rules :—

The minimum for 1st Division will be 60 per cent. of full marks.
" 2nd " " 50 " "
" 3rd " " 40 " "

It is not intended to prescribe these percentages for all the classifications undertaken by the Colleges : they must obviously vary according to the difficulty of the papers and the amount of option allowed to candidates in selecting the questions to answer. But some guide is necessary in order to secure that a First Division shall represent as nearly as may be the same degree of merit at all Colleges. The experienced Examiners who will be responsible for the classification in the several Colleges, should find little difficulty in fixing a standard which will make the minimum for their Divisions correspond with that prescribed above for classification by the Department.

6. To obtain a Certificate, candidates must gain a place in the Class Lists for both Part I. and Part II., and, to be qualified to superintend pupil teachers, must gain a place in the 1st or 2nd Division in both Class Lists.

I have the honour to be,
Sir,
Your obedient servant,
G. W. KEKEWICH.

To ———
——— *Training College.*

COURSE 'B' IN ARITHMETIC.

A COMPLETE SYLLABUS FOR A YEAR, IN MONTHLY SECTIONS, WITH TESTS.

BY B. ELDERKIN,
Model School, Westminster Training College.

For Introductory Notice and First Month see February number of PRACTICAL TEACHER, 1896.

STANDARD I.

Syllabus—12th Month.

(*a*) Revision.
(*b*) Shillings Table to 60 shillings.

Test.

1. How much less than 98 are 15 + 13 + 29 + 36 ?
2. Multiply 16 by 5.
28 by 3.
14 by 6.
3. How many times are —
3 contained in 19.
4 " 38.
5 " 74.
6 " 87.
4. There were 13 pencils in 1 box, 15 in another, and 26 in another ; if they were equally divided between all the boxes how many would there be in each box ?

STANDARD II.

Syllabus—12th Month.

Revision of year's work.

Test.

1. Find the sum of 12s. 6d., 5s. 9½d., 113 pence, 75 halfpence, and 157 shillings.
2. How much more must I save to buy a £2 watch, if I have saved £1 13s. 6½d. ?
3. Multiply 13s. 8¾d. by 9.
4. Find the seventh part of three times £2 15s. 6d.

STANDARD III.

Syllabus—12th Month.

(*a*) Revision of year's work.
(*b*) Prepare tables for work of Standard IV.

Test.

1. What number when multiplied by 56 will give 41944 ?
2. How much must be added to £5 17s. 9½d. to make £10 11s. 6d. ?
3. How many houses worth £450 each could I buy for 15 houses worth £150 each ?
4. Find the cost of 15 pieces of cloth, each containing 8 yards, at 2s. 11½d. per yard.

STANDARD IV.

Syllabus—12th Month.

(*a*) Revision of year's work.
(*b*) Completion of Tables for Standard V.
(*c*) Explanation of Metric Tables of Weight and Capacity.

Test.

1. Add together 251 lbs., 274 cwts., 5 tons, and 56 qrs.
2. If one cask contained 24 gals. 3 qts. 1 pt., how much would 58 such casks hold ?
3. Find what an expenditure of 2½d. per hour would amount to in the month of September.
4. How many hurdles 3 ft. 6 in. long would be required to go round a field whose sides respectively measure 130 yds., 56 yds., 79 yds., and 84 yds. 1 ft. 6 in. ?

STANDARD V.

Syllabus—12th Month.

(*a*) Revision.

(*b*) Metric Tables of Weight and Capacity.

Test.

1. A sum of money is divided among 4 persons. A has $\frac{2}{5}$, B $\frac{1}{3}$, C $\frac{1}{4}$, and then £5 is left for D; what was the whole sum?

2. Find the cost of 9 trucks of coal, each containing 5 tons 15 cwt., at 21s. per ton.

3. Work this bill—

$3\frac{1}{2}$ doz. oranges at $1\frac{1}{2}$d. each.
3 bags potatoes, each 56 lbs., at 3s. 6d. per cwt.
4 bush. apples at 3s. 9d. per bush.
$1\frac{1}{2}$ cwt. onions at $\frac{3}{4}$d. per lb.
57 pt. nuts at $2\frac{1}{2}$d. per qt.

4. The front wheel of a carriage measures 3 ft. 6 in. round, and the back wheel 5 ft. 8 in.; how many times would each turn round in a distance of 1 mile 1270 yds.?

STANDARD VI.

Syllabus—12th Month.

(*a*) Revision.

(*b*) Metric System. Tables of Length and Area.

Test.

1. Simplify $\frac{95\cdot76}{\cdot019} \times \frac{4}{9}$ of $\frac{\cdot000486}{\cdot00504}$.

2. How many men must be employed to finish in a fortnight the same work that it would take 20 men five weeks to do?

3. How many apples at 6 a penny could be bought for 12·125 of ·75 shillings?

4. Find Simple Interest and Amount of £750 for half a century at $2\frac{1}{2}$ per cent.

5. How many cubes of 3″ sides could be cut out of a block of timber 15 ft. long, 18 in. wide, and 9 in. thick? (*Boys only.*)

STANDARD VII.

Syllabus—12th Month.

(*a*) Revision.

(*b*) Metric Tables generally with easy calculations and reductions.

Test.

1. A person's salary is £350 a year; he has also £150 coming in from Railway Shares and £50 from Consols; what income tax should he pay at 8d. in the £ if £160 of his income is exempt from taxation?

2. If cloth cost 2s. 10d. a yard, for what must I sell 50 yards so as to gain 15 per cent.?

3. Work this sum by decimals and vulgar fractions so as to prove the correctness of your answer—

$$\frac{1 - \cdot75016}{\cdot0096}.$$

4. A man has £1000 left him. He invests in Consols when they are at $103\frac{1}{8}$. How much stock can he buy, and what will be his interest on his money at $2\frac{3}{4}$ per cent.?

TESTS—TWELFTH MONTH ANSWERS.

Standard I.—(1) 5; (2) 80, 84, 84; (3) 6 + 1, 9 + 2, 14 + 4, 14 + 3; (4) 18.

Standard II.—(1) £9 7s. 10d.; (2) 6s. $5\frac{1}{2}$d.; (3) £6 3s. $6\frac{3}{4}$d.; (4) £1 3s. $9\frac{1}{2}$d. + 5.

Standard III.—(1) 749; (2) £4 13s. $8\frac{1}{2}$d.; (3) 5; (4) £17 15s.

Standard IV.—(1) 19 tons 10 cwt. 27 lb.; (2) 1442 gals. 3 qts.; (3) £7 10s.; (4) 291.

Standard V.—(1) £300; (2) £54 6s. 9d.; (3) 5s. 3d., 5s. 3d., 15s., 10s. 6d., 5s. $11\frac{1}{2}$d. = £2 18s. $11\frac{1}{2}$d.; (4) $2597\frac{1}{2}$, $1604\frac{3}{17}$.

Standard VI.—(1) 216; (2) 50; (3) $654\frac{3}{4}$; (4) £843 15s., £1593 15s. (Girls); (5) 1080 (Boys).

Standard VII.—(1) £13; (2) £8 2s. 11d.; (3) $26\frac{1}{40} = 26\cdot025$; (4) £969 13s. $11\frac{3}{4}$, £26 13s. 4d.

VISITS OF INSTRUCTION.

VI.—THE PRINTING OFFICE OF HER MAJESTY'S PRINTERS.

MESSRS. EYRE AND SPOTTISWOODE are not only Her Majesty's Printers, but also the printers of THE PRACTICAL TEACHER. There was, therefore, on two distinct grounds, a special interest in paying a visit to the extensive works at Hackney, to which the firm had kindly granted us special permission to take a small class of boys.

The office is situated at the corner of Downs Park Road, a short distance north of Dalston Junction and east of Kingsland High Street. It covers a large extent of ground, as a considerable part of the building is of low elevation, having only one main floor. Presenting ourselves punctually at ten o'clock one morning, we met with a pleasant business-like welcome from the manager, who placed us at once under the guidance of the manager of the composing department.

The first part of the establishment to which we were taken was a large room where the composing is done. This is called the *case room*, from the name given to the box or set of boxes in which the type is arranged before the compositor or workman, who takes out each separate letter required to print a page or portion of a book, and sets it in its proper place. Our guide pointed out to us how the *case* contains a number of separate divisions—one for each letter, figure, or sign—one also for each variety of blank space or *quadrat*. These divisions contain stocks of the letters, etc., in varying numbers according to the frequency with which the respective letters commonly occur. They are not arranged in alphabetical order, but so that those most often used may be readiest to the workman's hand, and those of less frequent use in the more remote parts of the case.

The type letters are cast in a mixed material formed chiefly of lead, but with a considerable proportion of tin and antimony to make the metal harder. The letter is formed at one end, called the *face*, of a small four-sided prism of this type-metal. As was pointed out to the boys, the letter on the type appears as the reverse of the printed letter. Our guide took a *composing-stick*—which is a shallow iron box with a bottom and three sides, one of which is movable for adjusting the length of lines—and having asked one of the boys what his name was, soon set the letters in their proper order therein. As the types are taken in order they are placed next each other from left to right, but with the top of the letter towards the operator. When as many words are composed as will fill the width of the stick, the spacing between the words is justified so that the line exactly fits; then another line is composed in front of the last, and so on until the stick is filled. The compositor then lifts the lines on to a *galley*—a flat surface of metal or wood with two or three raised sides, placed at his side on the frame, slanting downwards—repeating the operation until the galley is filled, or the article, if making less than a galley of matter, is complete. After which the type is secured by a long iron wedge, called a *side-stick*, and small wooden wedges, called *quoins*, placed between the matter and the upper side of the galley; the type, as will be readily understood, being read from left to right, so that when the pressman, to whom it is now handed, pulls an impression, it appears in the reverse direction, as we see it in books and newspapers. This proof, as it is called, is then given to the reader, who marks any errors, and when the matter is finally corrected, it is made into pages, which are placed in an iron frame, called a *chase*, and secured by similar wedges to those used when the matter was on a galley. The number of pages placed in a chase varies according to their size or the size of the sheet of paper to be printed on. Thus a sheet of folio contains 4 pp. in 2 formes; a sheet of quarto 8 pp. in 2 formes; a sheet of octavo 16 pp. in 2 formes; and so on.

Another important part of the printer's work with the type comes after the printing is done and the type is no longer required to be kept together. This is called *distributing* the type, and includes not merely loosening and separating the

letters, but placing each in its proper compartment of the type case. To do this with the necessary rapidity requires a great deal of practice.

One large room in the composing department of these works contains a number of racks, in which are stored *founts* or sets of type reserved for use when required. They are wrapped in paper parcels bearing in a conspicuous place the name of the sort and size of type, as L.P. (Long Primer), Cl. (**Clarendon**), Bour. (Bourgeois), Br. (Brevier), and so on, with a printed sample.

In many cases, especially when the number of copies required is not very large, the printing is done from the actual type set up as already described. This plan is adopted when several thousands of copies have to be printed, as it is indeed in the case of this journal. But when what the printer calls *long numbers* of one work have to be printed, as tens and hundreds of thousands of copies of newspapers, and of editions of the Scriptures and the Prayer Book, some different plan is adopted. If the composed type were continuously used it would get displaced, and possibly worn, so that the copies would deteriorate and the type would be unfit for use in further printing.

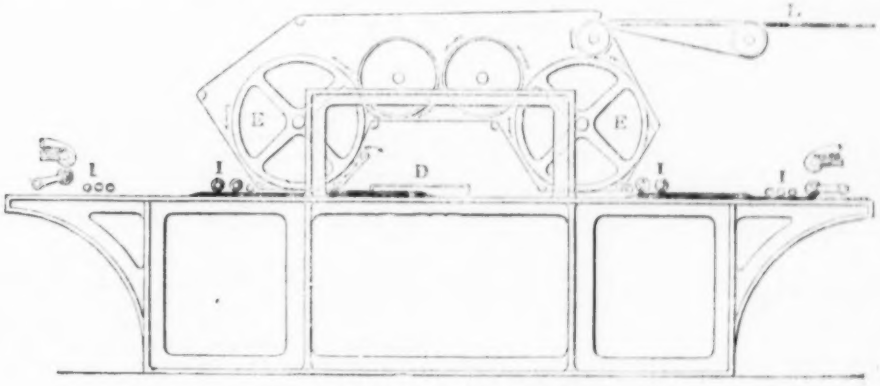
There are two chief plans for preserving the type and setting it free for other use. Both are in use at the office of Her Majesty's Printers, who produce almost numberless copies of the Bible and Prayer Book in numerous editions, as well as some popular periodicals, such as *Woman's Life*. The one plan is called *stereotyping*, the other *electrotyping*.

When a work is stereotyped, a mould is made of the pages composed of movable types. The substance commonly used is a sort of paper-pulp called *papier maché*. In this mould, called a *matrix*, is cast a plate of hard and durable type-metal, which is a fac-simile of the original composed page of type, but it is in a single solid piece instead of a multitude of separate letters locked together. The stereotype plates, that is plates of solid type, can be printed from, while the type is distributed and set up again to print other matter. The plates can be kept permanently and used when required, and if necessary others may be cast from them.

The second method is similar in its application, but the process is very different. During our visit we were taken to a part of the works called the *Foundry*. The mode of making the electrotype plates is extremely interesting. A mould is first taken by wax being pressed upon the type surface. This mould is first coated with blacklead and then placed in a bath containing a solution of sulphate of copper. By causing an electric current to act upon it a shell of copper is deposited on the mould, and this shell, which is an exact reproduction of the page of type, is afterwards strengthened by being backed with a mixed metal. The plate, which is rather thick when first made, is planed down at the back to make it of uniform and convenient thickness. Some of the plates we saw in course of manufacture were for the journal called *Woman's Life*. Electrotyping is extensively used for printing illustrations in books and magazines.

We were also shown through the *Strong Room*, where are stored nearly two millions of these plates, each one representing a page of some of the numerous editions of the Scriptures or of some other work in constant demand. The plates are all arranged in sets, labelled and placed in racks, from which they can be taken and made into formes for the printer's use whenever any fresh supply of copies of a book there represented may be required. Amongst the plates taken down and shown to us were some pages of the 'Acts of the Apostles' in Greek, 'The Pilgrim's Progress' in Welsh, and various others. The value of this stock of plates is enormous, and hence they are kept in this *Strong Room*, specially protected against fire.

It is now time for us to proceed to the *Machine Department*. Over this we are taken by the veteran manager, who can look back to his first entrance to this office as printer's reading boy fifty-seven years ago. He is still, however, alert and anxious to keep abreast of the times, and he makes a cheery, genial guide. In the machine rooms we were shown a great variety of printing presses at work, or in preparation for work. Here were miniature machines, of the Cropper or Minerva pattern, being used to print small sheets of Government papers, *cancels*, and other small works. Some of the machines we saw were almost like hand-presses, and are used only for such works as require special care and need not be produced very rapidly.



PERFECTING CYLINDER MACHINE.

A larger machine of peculiar construction was printing *telegraph forms* with duplicates. Several copies of the form were printed on each sheet, but as the duplicate was different in certain respects from the original it was printed on another part of the same machine, which was called a *two-feeder*. Then by a curious contrivance each sheet was taken up in turn by a frame and placed on a pile in which the two kinds of sheet, the original forms and the duplicates, were arranged alternately. This stacking of the sheets was done entirely by the machine acting automatically. We were informed that this printing of telegraph forms is constantly going on, and if by any chance the two-feeder machine is out of order, the work is much increased, as the form and duplicate have to be printed at separate times and arranged by a less ready plan.

The machine on which THE PRACTICAL TEACHER is printed is called a *Perfecting Cylinder Machine;* and as this has a particular interest for us, and also illustrates several remarkable contrivances of mechanism, we will endeavour to describe its action in some detail. To assist in making our description intelligible, we give a sectional drawing of this machine which, by the kind permission of Messrs. George Bell and Sons, we reproduce from their 'Technological Handbook of Printing,' by C. T. Jacobi.

The sheet of paper to be printed is placed on the *laying-on board* L by a workman called a *layer-on*. It is then carried on tapes, represented in the drawing by thin lines, under the first cylinder E. Following the direction of the small arrows, it is then carried over the first small cylinder and under the

second. It next passes over and then under the second large cylinder, and so reaches the *delivery-board* D, between the two cylinders. Here it is taken up by another workman, and is found to be completely printed on both sides, which supplies the reason for the name *perfecting* machine. The thick black horizontal lines represent the tables or beds which carry the type-formes backwards and forwards under the impression cylinders, and the small black rings, I I, represent the rollers of the inking apparatus. If the reader will follow the course taken by the paper as indicated by the arrows, he will see how the sheet is reversed as it passes from the first to the second impression cylinder; and this accounts for the two-fold printing of the sheet. Each forme contains sixteen pages of type, so that when the whole sheet is delivered it has thirty-two pages printed on it. These sheets, however, are cut in two, and so each one makes two sheets of sixteen pages of royal octavo size. When the machine is running it can deliver one thousand copies an hour, but with allowances for stoppages, such as may for various reasons be necessary, its ordinary output is 800 or 900 per hour. We are glad to be able to add that owing to the remarkable increase in the circulation of the PRACTICAL TEACHER since the beginning of last year, the work of this machine in printing it has been practically doubled.

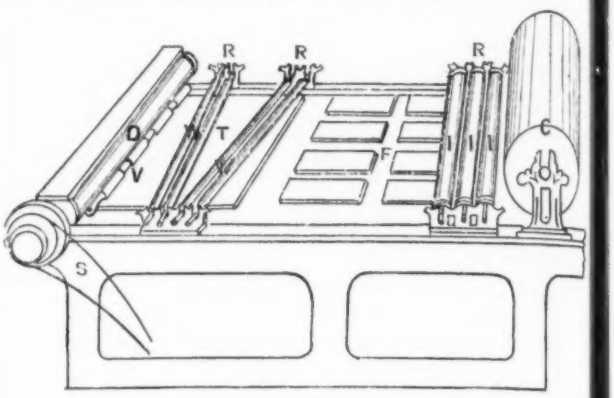
So far we have described only the mechanical action of this admirable printing machine. But our guide kindly explains to us two or three interesting features of the work connected with it, and we will endeavour to pass on his explanation.

First, the process of *making ready*. This consists of placing round the impression cylinders what is called a *blanket*. A piece of calico is wrapped tightly round the cylinder, over this a number of sheets of paper are pasted down smoothly, and then comes the blanket of a woollen material of fine and even texture. For important work, like that of this journal, the best cashmere is used. The object of this is to secure that the impression shall be even as well as clear, and that the rolling of the cylinder shall not damage either the paper or the face of the type. If on a trial *pull* or impression being taken it should be found that, notwithstanding the careful justifying and regulating of the type, some parts of the forme touch the cylinder too lightly to give a clear print, extra padding is placed under the blanket to bring those parts into more uniform contact.

A further interesting process connected with 'making ready' is that of making an *overlay* for the purpose of printing the illustrations from electro plates in a more effective manner. An artistic workman is engaged on two or three *pulls* or flat impressions taken from a process block which gives a portrait of a teacher whose literary reputation has attracted much attention. The worker is cutting out the full lights or white portions in one of the prints, and the medium shades or lower lights in another. The three copies are then pasted in order one over the other, and this, which is called an *overlay*, is laid on the impression cylinder so as to be exactly at the back of that part of the paper which will pass over the process block placed in the type-form. The effect is to vary the pressure in printing so as to heighten the contrasts of light and shadow in the picture, and thus make it more distinct and definite. The plate we saw treated appeared in a recent number of this journal. It is with much pleasure that we dwell on this process of making *overlays* for illustrations, since it is precisely in this process that printing becomes a branch of fine art. Though most of the blocks we have so abundantly introduced during the past twelve months have been produced by one of the finest half-tone processes employed, they could not have been so effectively reproduced but for the artistic work of the *overlay cutter*, and the skill and care exercised by the machine minder who *makes ready*.

Another incident to be noticed here is the contrivance for preventing the *set-off*. The *set-off*, it should be explained, is the deposit of ink from a sheet already printed on to a clean sheet. In the perfecting cylinder machine this needs specially to be guarded against, as the side printed by the first cylinder is turned over and comes next the second cylinder. To prevent the paper from being soiled by it, strips of oiled paper are passed round the outer cylinder and one of the drums, so as to make endless bands. The strips receive all the off-set of ink; but they have to be renewed after about 500 sheets have been printed, since in that time they have themselves become soiled and would not therefore continue to serve their purpose.

The arrangements for supplying ink to the face of the type are also worthy of notice. As may be seen from our first illustration, there is a complete set of inking apparatus at each end of the perfecting cylinder machine. We are glad to be able



INKING APPARATUS.

to give a fuller drawing of one of the two sets. The reference letters will help to make clear the process of inking. D is the *ink-duct*, a shallow trough containing the ink, which is let out by a long thin iron plate called the *knife*, the quantity required for each impression being regulated by screws or keys. The duct contains a metal roller called the *ink-cylinder*, and from this the ink is lifted at intervals by the *vibrating roller* V. The ink is thus brought on to the ink table T. The small rollers, W, which cross the table obliquely, are called *wavers*, and their purpose is to distribute the ink evenly over the table, which they do by a backward and forward motion caused by the machinery. While the forme F is taken under the impression cylinder, the table which is attached to it travels under the three rollers called *inkers*, I, which receive from it the necessary quantity of ink and deposit it on the type surface when the forme returns from under the cylinder.

The ink rollers are made chiefly of glue and glycerine. Formerly treacle was much used with the glue, but glycerine has taken its place, as being cleaner and less sticky. Great care has to be taken in the use and fitting of the rollers, or the ink would be unevenly spread over the type, and imperfect print would be the result. They are changed about once a week, the used rollers being taken away and thoroughly cleaned. Those that are much worn and uneven are stripped, and the materials are washed, melted, and remade.

In order to economise the ink and also to prevent the margins from becoming soiled, it is a common practice to cut grooves round the ink rollers at intervals corresponding to the marginal spaces between the pages of letterpress.

Leaving now the PRACTICAL TEACHER machine to go on with its own work, we have our attention directed to several other machines of various patterns and sizes adapted to the different kinds of work upon which they are employed. For example, here is a *Platen* machine, in which the sheet of paper is spread on a flat frame, and then let down on to the type surface or forme, also lying flat on a fixed horizontal bed over which rollers pass to give the impression. On this are being printed sheets of a Diamond Reference Bible. The word Diamond refers to the very small type in which it is set.

The *Wharfedale* is a single cylinder machine of which several examples are at work. It is used for printing one side of the paper at a time, but its action is similar for this process to that of the cylinder machine already described. The table or bed on which the type forme is laid moves horizontally under a cylinder which revolves and brings with it the paper, which receives an impression as the type forme passes under it. On a machine of this kind we saw sheets of the new Savoy edition

of Shakespeare's Works being printed. As this book has a border of red lines on each page, each sheet has to pass four times through the press, twice for each side. First the red part of the page is printed, and then, on another machine, or at a later time, the black letterpress.

Similar machines were engaged in printing the beautiful coloured covers for the well-known periodical *Woman's Life*. Two colours were being used, Bartolozzi Red and Violet Blue, but each has to be printed separately.

In all cases where the same sheet has to pass more than once through the machine it is important that the paper shall occupy an exactly corresponding position each time; otherwise there would be overlapping of the colours, failure to meet in places, or other imperfections. To secure this necessary correspondence, pointing holes are made in the sheet when first printed, and this is done by pressing the paper on the machine on two or more fixed pegs, called *points*. Then the workman who lays on the paper has to take care, when placing the sheet the second time on the machine to print the other colour, that the *point holes* fit exactly on the points. This is called bringing the sheet *into register*. This matter has also to be equally attended to in printing the second side of a sheet of paper, so that the position of the letterpress on the two sides of the leaf shall correspond. In the case, however, of the Perfecting Cylinder Machine, there is no need of points and point holes, as the construction of the machine secures that the two sides will be kept *in register*.

On other machines were being printed various editions of the Bible: a Thumb edition in small type with 128 pages to the sheet, or another in large folio size. 'The Bible in many Tongues,' a work which gives specimens of the Scriptures in several languages, was passing through one of the machines; parts of the New Testament in Greek through another; and a book of hymns and prayers for use in American churches through a third, while another machine had just ceased printing the plates for the illustrated portfolio, 'Round London.' The latter, as needing special care, are printed at the rate of about 500 sheets per hour.

Everywhere, by the kindness of our guide, our attention was called to the points of greatest interest.

After our inspection of the Machine department, we went to the rooms where the printed sheets are examined, gathered, and collated. Any imperfect sheets are rejected, the rest are arranged in stacks according to their *signature*. The *signature* is the mark, usually a letter of the alphabet, which is printed at the foot of the first page of each sheet. Thus the signature of the first sheet of a book is usually B, of the second sheet C, and so on.

An interesting operation is that of *gathering*, or arranging the sheets in order, so as to form single copies of complete books. This was being done for a book consisting of about a dozen sheets. On the outer part of a large ring-shaped revolving table were stacks of the sheets, each pile being of one signature, and the several signatures following one another in order. A number of young women stand round the table, and each takes one sheet from each stack, placing their collection to one side when they have taken a complete set. Thus the stacks are rapidly sorted so as to form separate books.

The process of *collation* which follows is that of examining the sets to see that no sheet is missing, and that there is no duplication of sheets. When this is done the completed sets are packed in parcels of different numbers, according to the size of the book; for example, one parcel may contain only five sets of sheets for a large-sized Bible, while another may have 50 of a smaller one, and another as many as 150 of a still smaller book. Each parcel is labelled outside so as to show the number of sets and the size and title of the book it contains. In the large warehouse close to the gathering and collating rooms, we saw great piles of these parcels stored, and learned that a stock is kept up of as many as a million and a half copies of the Scriptures, parts of the Scriptures published as separate books, and other works in constant demand. As the orders are received, the parcels required are taken out of the warehouse to the folding, cutting, and binding departments.

Through the rooms in which these various operations are performed we were next taken, and many were the matters of interest that detained us. In the folding room a curious machine was being used to fold a magazine, by a series of flat blades moving downwards, backwards, forwards, and upwards. Each of these movements gives one fold to the sheet, and when completely folded it drops into a receptacle ready for sewing, or for being fastened together with wire-binding. Another machine inserted and turned down the wire fasteners, and another cut the edges.

In the binding room, women and girls were occupied in sewing with thread the sheets of Bibles and Prayer-books. Some fastened the collected sheets to linen or canvas backs, which were afterwards glued or pasted into covers made of cardboard. The next step was the covering of these cases with leather or with bookbinder's cloth. We were much interested in the last stages of book-making—the binding, lettering, impressing, and gilding. But over all these we must hasten, for a full description of this work would make our paper too long; and we may have another opportunity of dealing separately with the bookbinder's art.

The printing offices of Her Majesty's Printers are admirably suited for the purposes of our visit, on account of the great variety of styles of printing and other kinds of workmanship there exemplified, as also for the high quality of their finished productions, and the general excellence of their arrangements. Our best thanks are due and are hereby tendered to the Firm and to the managers of departments for the facilities they kindly afforded us, and for the kind manner in which they contributed to make our visit pleasant and instructive.

We trust our record will not be found too technical to be interesting to our readers, but that in its various details they will be able to find materials and suggestions which may prove practically serviceable in their teaching on an important British industry.

There are, we are aware, many other points of interest relating to printing which we have not dealt with; and the art is one which forms so large an element in modern civilized life that every aspect of it is worthy of consideration. We have not dealt with the historical development of the art, from the time of the early printers Gutenburg and Caxton; nor have we referred to the extraordinarily rapid multiplication of copies by the great Rotary machines, which are capable of printing 20,000 copies of a large newspaper in an hour.

For teachers who may desire additional information on the subject, we may mention Mr. Jacobi's book on 'Printing,' to which we are indebted for our illustrations. As a manual intended for practical workmen and master printers, this is almost purely technical, and presupposes a considerable degree of actual acquaintance with the ordinary operations of printing. A capital little book of a popular kind on the history and development of the art is 'The Triumphs of the Printing Press,' by Walter Jerrold, published by Messrs. Partridge & Co. It might well find a place in every school library; for it traces the progress of printing from its earliest stages down to the late Mr. William Morris's revival of Hand Printing at the Kelmscott Press. Lastly, we commend to the teacher's notice a chart recently issued by Edward Lloyd, Limited, under the title 'The A B C of Printing.' This presents the three stages of the art, with illustrations of (*a*) the old hand press, (*b*) the simple cylinder machine, and (*c*) the Rotary or compound cylinder machine, each with a brief description. A companion chart illustrates the process of colour-printing or chromo-lithography, by showing the various stages of printing one of the coloured posters for advertising *Lloyd's Weekly Newspaper*.

IN OUR NEXT NUMBER we hope to insert an Illustrated Article dealing with the subject of '**ART DECORATIONS FOR THE WALLS OF THE SCHOOL-ROOM.**'

OUR FRENCH PRIZE COMPETITION.

Prize Editor.—W. T. THOMPSON, B.A. (LOND.), *First Class French Honours.*

PRIZE AWARD—FEBRUARY.

The Prize is awarded to *French Student*, the pseudonym of L. WILKES, 232, Friern Road, East Dulwich, S.E.

First Class.—Spiked Helmet, Gamma, Lucifer, Perthshire, Buchan, Clunie, Rule Britannia, St. Brelade, Idiotes, Eau Gras, Nortoniensis, Anglo-Saxon, Timid, Gallia, Heron, Heathen Chinee, Emil, Nelly, St. Servan, Mat, Teresa, Garnet-hill, L'Espérance, Nero, Nigger, Arbor, Quieta, Albion, Irena, Glanage, Chalk, W. M. E., Honi soit qui mal y pense, Moness, Aglaia, Ireton, Stigand, Koorali, Iseult, Vincent, E. S., Orkney, Zimbabwe, Riddings, Fintry, Do and hope, Belvidere, Sans Espérance, Pro Bono Publico, Echo, Scotia

Second Class.—Jeanne, Grip Fast, Veritas, Anglaise, Pelican, François, Jersiais, Meg Merrilies, Alpha, Jupiter, Verus, Pedagogue, Harengs, Souvestre, Etak, Lilybank, White Heather, Bishop Leighton, Tednis, Hamlet, Koh-i-noor, Nous, Anax, La Mayeux, Swarthmoor, Legiolium, Hopeful, Maid Marian, Sincérité, Sweet William, Marie H——, Dunedin, Thule, M. J. P., Aurora Borealis, Throstle Nest, Lorna Doone (2), Normano, Quelqu'un, Viking, Ninon, Le Chevalier, East Anglia, Atalanta, Ignoramus, Kenilworth.

Third Class.—J., Greenhill, Wellingtonia, Moses, Treize, Mandubracius, St. Magnus, Flo, Excelsior, Lorna Doone, Agnes, Idola.

On s'aperçut très vite que le siége allait tourner au blocus, et que ces approvisionnements, faits à la hâte, sans ordre, et par manière de plaisanterie, ne dureraient pas longtemps. Toute la ville, alors, d'un même mouvement, se précipita, les mains tendues, chez les marchands de comestibles. Du jour au lendemain, tout haussa de prix. Il se formait aux portes des épiciers et des charcutiers de longues queues de ménagères, qui venaient chercher du fromage, des jambons, des saucissons et autres victuailles. On riait encore, à ce moment-là, de cet empressement ; on ne se doutait guère que l'heure était si proche des détresses réelles, et des sérieuses souffrances.

Il se produisit un phénomène bien curieux, et qui serait difficile à croire, si nous ne l'avions tous constaté : c'est l'appétit dévorant dont Paris tout entier fut sur-le-champ saisi. Jamais il n'avait fait si faim dans la grande ville. Jadis on y mangeait pour vivre, et sans trop faire attention aux morceaux. Il eût été bien difficile de trouver un Parisien qui raisonnât son déjeuner. Aussitôt le siége commencé, nous entendîmes tous nos entrailles crier d'une étrange manière. Nous contemplions, en passant, les vitrines des magasins de comestibles avec des yeux de convoitise ; les énormes piles de boîtes en fer-blanc, les rangées de pots où étincelaient les confitures jaunes ou rouges, ces tonnes de harengs pressés, tout cet appareil de la mangeaille qui s'étale aux montres des épiciers nous mettait l'eau à la bouche, et nous jetions sur cet espoir de nos repas futurs des regards mouillés de tendresse. Tel qui déjeunait de deux œufs sur le plat et d'un morceau de fromage, ne voulait plus se contenter à moins d'un bifteck saignant, arrosé d'une bouteille de bordeaux. L'estomac parlait-il plus haut ? l'écoutait-on davantage ? Grave question, et que je laisse à résoudre aux moralistes. Ce qu'il y a de certain, c'est qu'en prévision des jours d'abstinence forcée chacun s'appliquait à manger plus et mieux. La chère était plus abondante et plus délicate. Il semblait qu'on se dît à part soi : autant de pris sur l'ennemi ; encore un que les Prussiens n'auront pas.

FRANCISQUE SARCEY.

Translation.

People soon perceived that the siege would become a blockade, and that the supplies, stored hastily, pell-mell, and almost jestingly, would not last long. The whole city, then, with one impulse, hands outstretched, rushed to the provision dealers'. From one day to the other the price of everything rose. At the door of grocers and pork-butchers there gathered long lines of provident housekeepers, who came to buy cheese, hams, sausages, and other comestibles. Ah ! we could still afford to laugh at that time, little suspecting that the hour of real distress and keen suffering was fast approaching.

A strange phenomenon then occurred, one hardly to be credited had it not been witnessed by all of us, namely, the famishing appetite which seemed to have seized all Paris. Never had such craving for food made itself felt in that great city. Formerly people ate to live, without paying much attention to what was set before them ; it would have been quite strange to come across a Parisian who would have discussed the menu of his lunch. But as soon as the siege began, our very stomachs seemed to cry out, imperatively demanding food. As we passed along we would study the windows of provision dealers, eyes full of covetousness ; the enormous piles of tins, the rows of jars full of sparkling jams, rosy and golden, the barrels of closely-packed herrings, all this show of dainties which grocers display, made our mouths water, and the glances we cast at all this earnest of future meals were quite moist with tenderness. The man who used to lunch on two fried eggs and a piece of cheese could not be satisfied now unless he had a succulent steak, washed down with a bottle of claret. Were the demands of the body for food really greater, or did we study our wants more ? It is a serious question, and I shall let the moralists solve it. What is certain is that, foreseeing days of forced abstinence, every one tried to eat more, and to eat better. The fare was abundant and more delicate. It seemed as if one was saying to oneself : 'So much the less for the enemy, another thing saved from the Prussians.'

FRENCH STUDENT.

The number of candidates who competed this time was, we believe, the largest we have ever had, and there was a high proportion of really good papers.

The difficulties most generally felt were the impersonal use of *il* in *Il se produisit un phénomène, etc.*, and the word *morceaux* in *sans trop faire attention aux morceaux.* A very large number did not grasp the use of this word as 'viands,' and translated it variously as 'scraps,' 'fragments,' 'odds and ends.' A fairly large number in translating *On riait encore, à ce moment-là, de cet empressement*, did not notice that *à ce moment-là* must be connected with *riait*, and consequently translated 'at that moment of eagerness.'

Despite the large number of good papers, many curious mistakes in translation were made.

Les mains tendues was translated 'grasping the money in their hands.' The same competitor boldly inserted in the next sentence, 'with the last of their long savings,' evidently thinking that *ménagères* here necessarily implied the idea of thrift.

D'un même mouvement was rendered 'with an automatic motion.'

Tout haussa de prix appeared as 'All advanced for the prize,' 'everyone seized some prize.'

Il se formait—charcutiers de longues queues, etc. The last phrase was translated 'pork-butchers of long standing.'

Sur-le-champ was translated literally as 'on the field.'

Qui s'étale aux montres des épiciers was translated 'which states before the watches of grocers.'

Tel qui déjeunait, etc. Tel was taken by one competitor as a proper name.

Il semblait qu'on se dît à part soi, produced some odd translations, the oddest of which was, 'Everyone seemed beside himself.'

Autant de pris sur l'ennemi was rendered, 'It seemed such a prize to the enemy.'

Il semblait—n'auront pas was translated by one competitor, 'It seemed that they might be said to be at their very birth ; so much was it assumed on account of the enemy ; a birth, however, of which the Prussians will have none.' Any comment would spoil the effect of this rendering.

Dans la grande ville was unfortunately printed as *sans la grande ville.* Most competitors saw the mistake, but none who did not have been prejudiced in the marking.

MARCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract :—

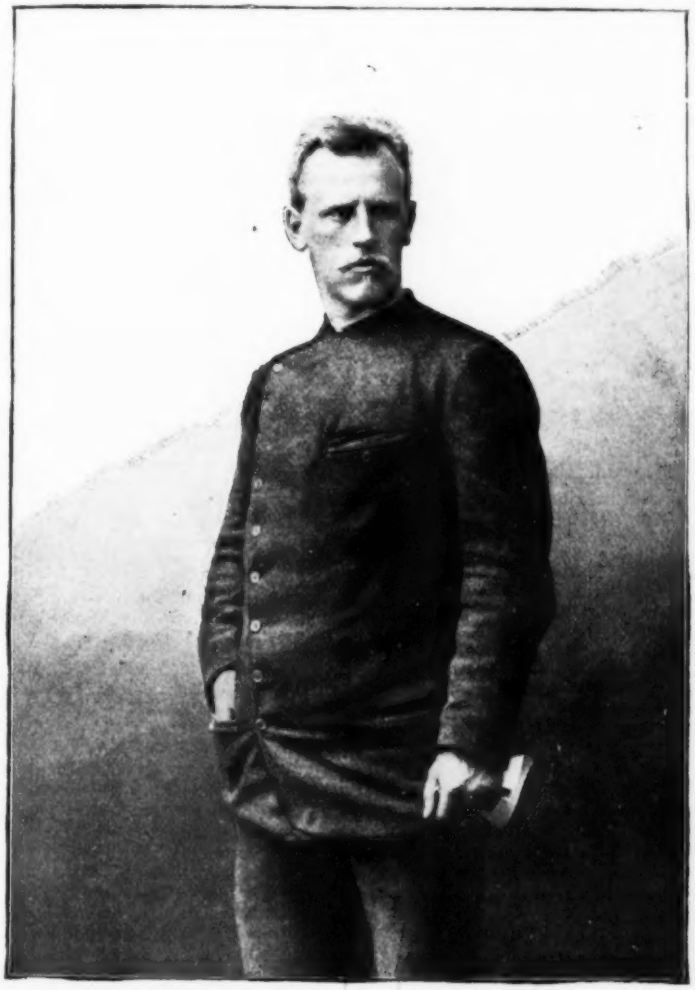
Ce Paris, elle ne le regretta pourtant pas, bien sûr, quoiqu'il y eût là beaucoup de choses belles et amusantes. D'abord, elle s'y trouvait presque à l'étroit ayant dans les veines ce sang des coureurs de mer. Et puis, elle s'y sentait une étrangère, une déplacée : les Parisiennes, c'étaient ces femmes dont la taille mince avait aux reins une cambrure artificielle, qui connaissaient une manière à part de marcher, de se trémousser dans des gaines baleinées : et elle était trop intelligente pour avoir jamais essayé de copier de plus près ces choses. Avec ses coiffes, commandées chaque année à la faiseuse de Paimpol, elle se trouvait mal à l'aise dans les rues de Paris, ne se rendant pas compte que, si on se retournait tant pour la voir, c'est qu'elle était très charmante à regarder.

Il y en avait, de ces Parisiennes, dont les allures avaient une distinction qui l'attirait, mais elle les savait inaccessibles, celles-là. Et les autres, celles de plus bas, qui auraient consenti à lier connaissance, elle les tenait dédaigneusement à l'écart, ne les jugeant pas dignes. Elle avait donc vécu sans amies, presque sans autre société que celle de son père, souvent affairé, absent. Elle ne regrettait pas cette vie de dépaysement et de solitude.

PIERRE LOTI.

DR. FRIDTJOF NANSEN.

ADDRESSING the Royal Geographical Society in 1892, Dr. Nansen said: 'We do not set forth to seek for the mathematical spot which forms the northern end of the earth's axis; to reach this particular spot is not, in itself, a matter of great moment. What we want to do is to investigate the great unknown regions which surround the Pole; and our investigations will have practically the same scientific value whether we reach the actual Pole or pass some distance from it.' He had a theory that a current flowed from the neighbourhood of Behring's Straits across the Polar Region and down the east coast of Greenland, as shown by the fact that several articles belonging to the *Jeannette*, wrecked near the New Siberian Islands, were found three years afterwards on the coast of Greenland. There were also evidences in the shape of driftwood, etc. Nansen's conclusion, therefore, was that if a ship could be built sufficiently strong to withstand the terrific pressure of the ice, then in time this current would take her in the direction of Greenland by way of the vicinity of the Pole. All the world now knows that he has succeeded, and that his plans have been carried out exactly as he arranged them at first. We make no apology for giving in these notes a few particulars concerning this truly remarkable man.



DR. FRIDTJOF NANSEN.

Born at Great Froën, near Christiania, on October 10th, 1861, he, at the age of nineteen, went to the University of Christiania, where his chief study was biology. Having a great natural love of sport and adventure, he, in 1882, joined a sealing expedition to the Spitzbergen seas and the coasts of Greenland and Iceland. Later on we find him Curator of the Natural History Museum at Bergen. At the age of 27 he took his degree as Doctor of Philosophy, and in the same year he set off upon his remarkable journey across the inland ice of Greenland from coast to coast, a journey which had never been accomplished before.

In 1889 he became Curator of the Museum of Comparative Anatomy at the University of Christiania, and at about the same time he married Eva, daughter of the late Professor Sars of Christiania University.

DR. NANSEN IN THE ALBERT HALL.

It was our good fortune to be present when Dr. Nansen told the wonderful story of the *Fram* and the journey over the ice when he and Johansen left the ship, taking with them three sledges, two kayaks, and 28 dogs to pull the sledges.

It was the most delightful story we have ever heard, told as it was with so much modesty and ready wit. We cannot, of course, attempt to describe the scene or to give a list of the well-known men and women who were present to do honour to the intrepid explorer. We must not, however, omit the names of H.R.H. the Prince of Wales, T.R.H. the Duke and Duchess of York, Sir Clements Markham, Admiral Sir Leopold McClintock, and Admiral Sir George Nares.

Dr. Nansen, it appears, had been afraid that no one would be able to hear him in that vast hall, and nothing short of a private rehearsal would satisfy him. Then he was convinced that all would be well, and he laughingly remarked, 'I think it is a very good place after all.' We cannot say that all the nine thousand who were present heard him on February 8th, but seated as we were in the front row of one of the boxes, quite close to the lecturer, we could see and hear without the least effort.

Sir Clements Markham, in introducing the lecturer, ably summed up the character of the man when he referred to 'his great ability and resourcefulness, his great knowledge, his marvellous powers of endurance, and, above all, those high qualities by which he made himself loved by all his followers.'

A TERRIBLE AND UNPARALLELED JOURNEY.

Life on board the *Fram* was all that the explorers could desire. Good food (chemically investigated before the voyage began), good books, card playing, scientific and astronomical observations, etc., etc., all helped to make 'a really good time.'

The danger was the pressure of the ice on the sides of the *Fram*, and, indeed, preparations were made for leaving her, as in January 1895 she was exposed to the worst ice pressure ever experienced by any ship. 'But,' said the lecturer amid loud cheers, 'the *Fram* proved stronger than our faith in her!'

No one after that had the least doubt as to the ability of the *Fram* to withstand anything and every thing. Then came the time when Nansen and Johansen bade farewell to their comrades and set off upon a journey over the ice absolutely unparalleled in the history of Arctic exploration. When they reached latitude 86° 14′ N., they thought it best to turn towards

Franz Josef Land. The story of their hut life and of their adventures, after leaving the *Fram*, is one that must be heard from the lecturer's own lips to be appreciated to the full.

Here is his description of Christmas Eve 1895 :—

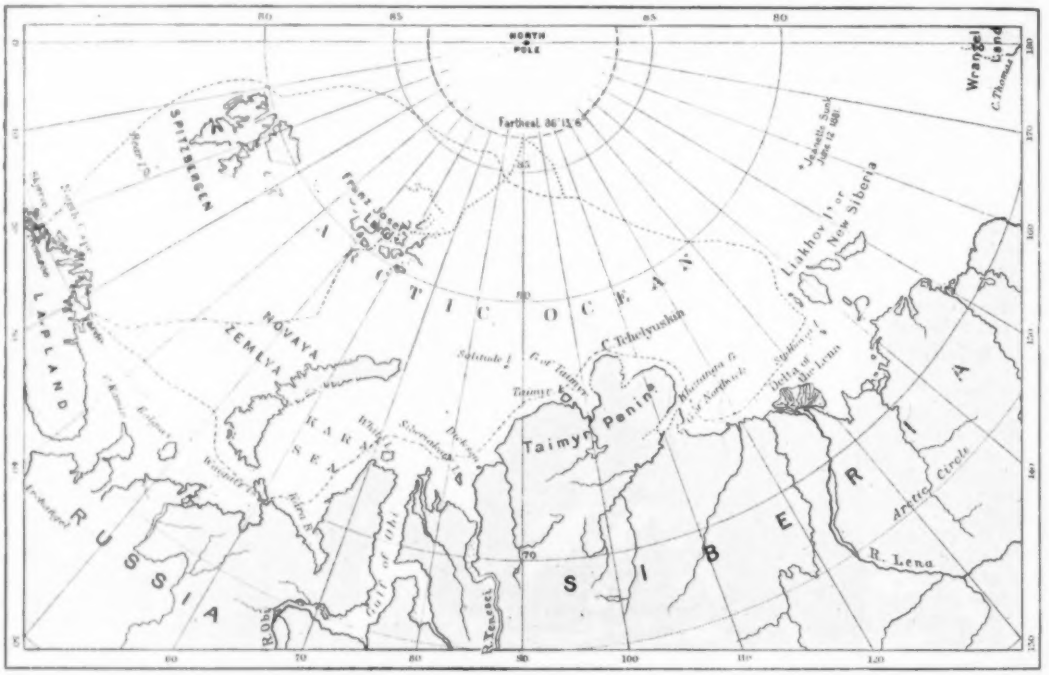
'And this is Christmas Eve, cold and blowing out of doors, and cold and draughty indoors. (Laughter.) How desolate it is here! We have never had such a Christmas Eve before. The bells are now ringing in the Christmas festival at home. I can hear the sound of them swinging out through the air from the church towers. How beautiful it sounds. Now the candles are being lighted at the Christmas-trees, and flocks of children are led in and dance around in exultant joy. I must have a Christmas party for children when I get home. (Laughter.) This is the time of joy, and there is rejoicing in every hut at home. We, too, are keeping the festival in our little way. Johansen has turned his shirt—(laughter)—and has put it on the wrong side out. I have done the same, but I have changed my drawers—(laughter)—and have put on the others, which I had rung out in warm water, and then I have washed myself in a cup of warm water—(laughter)—using the discarded drawers as a sponge and towel. I feel quite like another being. (Laughter.) My clothes do not stick to my body so much as they did before. (Laughter.) For supper we had powdered fish and Indian meal, with train oil for butter—(laughter)—and as sweets we had bread fried in train oil. To-morrow morning we are going to have chocolate and bread. (Cheers.)'

'Are You Nansen?'

The story of Jackson's 'discovery' of Nansen is told at length in the really magnificent edition of 'Farthest North,' recently published by Messrs. Archibald Constable and Co.

When the two men met, Dr. Nansen was clad in greasy rags, black with oil and soot, and with his fair skin and overgrown hair and beard almost black, was practically beyond recognition. Jackson, at any rate, did not know him, and some time elapsed before he asked, 'Are you Nansen?' Little more need be said here. Nansen is an artist and a man of letters, as well as an explorer, whose name will be handed down to future generations. A very large number of beautiful pictures (many of which were photographs taken on the spot), were thrown upon the enormous screen, an additional charm being thus added to the lecture, which was rich in interest and incident from start to finish. The presentation of the special gold medal of the Society to Dr. Nansen by H.R.H. the Prince of Wales, the graceful little speech made by the Prince in performing the function, the Doctor's eloquent and touching thanks, and the presentation of the replica of the special medal to Lieutenant Scott-Hansen were all items of interest in a most delightful evening's programme.

Englishmen will not forget the marvellous achievements of the famous Norwegian and his gallant crew, and we are confident the Doctor will never forget the hearty welcome he has received and is still receiving in this country.



The plain dash line shows route of the *Fram*. Plain dot, Dr. Nansen's sledge journey. Dot and dash, Dr. Nansen on the *Windward*.

OUR CHRISTMAS PRIZE COMPETITION.

THE offer of a prize for the best detailed description of the most suitable mode of using the picture on p. 417 educationally, provoked only a limited competition, much less than we expected. The method of treatment was purposely left entirely to the discretion of the competitors, and the result has been considerable diversity in the character of the papers.

The Prize is awarded to 'BEDA,' the pseudonym of Miss Hilda Clarkson, 181, Bow Road, London, E.

Commended :—

Florence Andrews, Bank Street, Melksham, Wilts.

A. M. Cunnington, Kindergarten Teacher, Taffna, London Road, Reading.

Beda's paper, which gives a very full range of treatment, is printed on next page.

Nemo has sent a good paper, but it includes little more than notes of object lessons on holly and mistletoe, and does not concern itself sufficiently with the particular nature of the picture.

H.G.D. is too diffuse, and deals with the general subject of picture teaching too much at large instead of describing more particularly the mode of using the given picture.

A CHRISTMAS PRIZE COMPETITION.

The most suitable mode of using the picture given on p. 417, educationally.

To be of practical use in an elementary school, this picture should be about 30 in. × 24 in. in size, coloured, and mounted.

I.—Infants' School.

To begin with the babies on the gallery, whose ages range from 3 years to 4½ years.

First Lesson.—Invent a very simple story about the children seen in the picture. Let the babies give each child a name, and call the adult their mother. (Of course she is evidently a home governess, but that would be beyond their comprehension.) When you have finished your story, call upon them to tell it to you by the help of your questioning.

Second Lesson.—Conversation lesson in which they are taught to speak about the appearance and actions of the children in the picture.

Third Lesson.—Conversation on Christmas Time and Christmas decorations.

Fourth Lesson.—Lesson on colour. Compare the colours in the picture with those in the colour box.

Fifth Lesson.—Any number of lessons on *Number* may be given with this picture in front of the class, viz., counting, adding, and subtracting hands, arms, eyes, etc.

Five Year and Six Year-Olds.—1. Object lesson on '*Helping mother* to get ready for Christmas.'

Second Lesson.—Conversation on what is to be seen in the picture.

Third Lesson.—Object lesson on holly, each child being supplied with a piece.

All the lessons mentioned for the babies would also be suitable for these classes if made a little more difficult.

In an infants' school where a Kindergarten picture forms the basis of all the lessons given to a class during one week, this picture might serve that purpose.

II.—Girls' School.

Standards I. and II.—Object lesson on 'Christmas decorations.' A simple outline could be made by the teacher of the chief features in the picture, traced in hektographic ink, and about 30 or 40 copies taken off on a graph. Then with the large coloured print in front of them, the children could *colour* their outline copies with chalk and stumps. This would form a most attractive Kindergarten lesson.

Standard III.—Questions relative to the picture should be put on the blackboard. The children then answer them on their slates in complete sentences. The questions should be so framed that the consecutive answers when finished form a complete and continuous story of the picture.

Standards IV. and V.—In these standards the picture would do for that style of composition called 'Story of a Picture.' The picture is hung in front of the class; each child makes a margin on her paper. In this she writes the names of all the *people* or *things* she can see in the picture. This done, she makes statements about these things, and thus builds up a complete history of what is to be seen in the picture. Children like these stories very much, and it is wonderful to see what they produce sometimes about a picture with perhaps only one figure in it.

POETRY FOR RECITATION PRIZE COMPETITION.

In our June number a Prize was offered for the best selection of passages of Poetry for Recitation to fulfil the requirements of Article 101 (*a*) (iii) of the Education Code.

The response to this offer was extremely disappointing, the number of competitors being very small indeed. The papers received were put aside, and the offer repeated in July, in the hope that more would come to hand; but as no others came, those already received have been for some time overlooked.

As practically every Head Teacher of a State-aided elementary school, except those for infants, has to prepare a list of pieces every year for the approval of H.M. Inspectors, we thought we should have a very keen competition in this matter.

Probably the requirement that copies of the pieces should be sent had the effect of limiting the number of competitors; but it seemed necessary that the actual pieces selected should be sent rather than their names only, to facilitate the work of judging. It was only required that each competitor should send one piece for each Standard, and the copy might be in print or manuscript.

In the opinion of the judges the best selection is that with the pseudonym 'Ruler,' which we find is that of Miss E. M. Boyce, L.L.A., 5, Fountain Street, Halifax, to whom the prize of One Guinea is awarded.

The number of selections sent in is too small to justify the award of a second prize. No other, indeed, has sufficient distinction.

We append 'Ruler's' selection in outline. It supplies more than was asked for, but it may be useful to our readers.

POEMS FOR RECITATION.

Title.	Author.	How to be obtained.
Standard I.		
'The Lamb' (20 lines).	William Blake.	In any edition of Blake's poems, that in the series of 'Canterbury Poets' (Walter Scott, publisher) is price 1s.
'Baby' (24 lines).	George Macdonald.	Found under the headings of 'Children's Poems' in George Macdonald's collected poems.
Standard II.		
'The Early Bird' (48 lines).	George Macdonald.	In collected poems of the author.
'Grandmother's Sermon' (48 lines).	Unknown.	Published in the 'Northern Poetry Cards' (Northern Educational Trading Co.) ½d. An alternative poem is given below.
'The Sleeping Beauty' (selections), 48 lines.	Tennyson.	A convenient form is the book published by Macmillan, with an abridged version of the poem, price 2d.
Standard III.		
'In the Children's Hospital' (45 long lines = 60).	Tennyson.	In any edition of Tennyson's poems. Publisher, Macmillan.
'The Pied Piper of Hamelin' (80 lines, rather short).	Robert Browning.	Published in many forms by several publishers. That in Green's 'Scholastic Series of Poetry Cards' is 1d.
Standard IV.		
'Winstanley' (112 short and easy lines).	Jean Ingelow.	Is issued in Part 2 of Cassell's 'Gleanings from Popular Authors,' 1d., which is the most convenient form for schools.
'The Cloud' (84 lines).	Shelley.	Is found with other poems by the same author in Stead's 'Penny Poets,' 1d. each, 'Poems of Shelley,' No. 28.
Standard V.		
'Jeanne D'Arc at Rheims' (94 lines).	Mrs. Hemans.	In Mrs. Heman's 'Poems,' in Stead's 'Penny Poets,' No. 38, price 1d.
The Legend 'Beautiful' (127 short lines).	Longfellow.	Stead's 'Penny Poets,' among Longfellow's poetry.
'Faithful unto Death' (140 lines, might be abridged if necessary).	Clifford Harrison.	Put in as an extra poem, because, though not by a standard author, it is well worth learning. It has been highly praised by one Inspector.
Two selections from 'The Light of Asia' (81 lines).	Sir Edwin Arnold.	Published by Trübner & Co., 3s. 6d. First selection from Book I., the second from Book V.
Standards VI. and VII.		
Selection from 'Samson Agonistes' (lines 1508–1672).	Milton.	Many cheap and excellent editions of the whole brought out by all publishers.
'The Bard' (140 lines).	Thomas Gray.	Green's 'Scholastic Series of Poetry,' 1d. A most valuable poem when History is taught in school.
'St. Phocas' (123 lines).	Sir Lewis Morris.	From 'The Vision of Saints,' published by Kegan Paul, 5s. Extract begins page 85.

'Ruler.'

INTERNATIONAL CORRESPONDENCE FOR TEACHERS.

IN the pages of the *Review of Reviews* for January last, some of our readers may perhaps have noticed an article under the heading, 'How to Learn a Language by Letter-Writing.' In it Mr. Stead briefly described and strongly advocated a proposal for the promotion of learning a living language—say French—by an organised system of correspondence between pupils of schools in England and France.

The idea of this proposal, which Mr. Stead calls, not without reason, 'a brilliant idea,' originated, it appears, with M. Mieille, a French teacher living in the South of France. In June of last year M. Mieille called the attention of French teachers to his plan in the *Revue Universitaire*, and in the January number of the same periodical he returns to the subject, enters into fuller details respecting the new means of cultivating a practical knowledge of living languages, and describes the steps which have been taken to realise his aims.

At the outset, it may be stated that M. Mieille's proposal is not a mere flash of novelty. It is based on an experience of some years, though that experience has been practically limited to his own and Madame Mieille's pupils on the one hand, and on the other to those English school children whom his relations with English people have enabled him to secure as correspondents.

The manner in which M. Mieille relates the inception and early progress of his experiments is so interesting that we venture to quote one or two paragraphs in his own words :—

'Il y a déjà quelques années, après avoir maintes fois constaté combien le thème de langue vivante paraît aux écoliers, même aux plus consciencieux, un exercice monotone et ardu, je me demandai si, à côté de cet exercice, qui reste évidemment indispensable, il n'y aurait point place pour un autre, libre, celui-là, spontané, plein d'intérêt et de vie, et je songeai à établir une sorte de commerce épistolaire entre mes élèves et des jeunes gens étrangers du même âge.

Voici comment j'organisai cette correspondence : Grâce aux bonnes relations que j'ai laissées en Angleterre, je pus bientôt trouver des correspondants, et je choisis, pour leur donner la réplique, mes meilleurs élèves de Rhétorique et de Seconde moderne.

Comme il était nécessaire que la correspondance offrit aux étrangers et aux Français un égal avantage, et, comme, pour garder son caractère d'exercice libre et spontané, elle ne devait pas empiéter sur les autres devoirs de la classe, je décidai que deux lettres par mois seulement seraient échangées. Mes élèves écrivirent la première lettre en français, la seconde en anglais ; leurs correspondants suivirent l'ordre inverse. Un jour, je leur suggérai l'idée de se corriger mutuellement, et cette idée fut accueillée des deux côtés avec une véritable satisfaction. Quel plaisir d'être tour à tour maître et élève ! Et cette correction était si amicale, si pleine d'humour et de joyeuses surprises !'

In this brief passage lies the essence of the scheme. The pupils of the two nations are paired one and one, and each writes his fellow correspondent two letters each month, one letter in each of the languages. Then the letter in the less familiar tongue, when corrected, is returned to the writer, who, it may well be expected, will derive much advantage from the correction.

M. Mieille tells us further that in the case of his own pupils he was careful not to intervene except upon request to solve a difficulty. At first, he says, he took a strictly professional view of his plan, and thought only of the immediate benefit which would accrue to his pupils from sharing in it. But it was not long before he saw other possible results ; that there was a patriotic side to his scheme, and that the friendly relations established between individuals would tend to bring about a better understanding—would help, if considerably multiplied, to strengthen the peaceful bonds between the nations.

The scheme has been submitted to high educational authorities in France and to Sir John Gorst in England, and meets with hearty approval from both quarters. M. Mieille, in a letter to us, says, after describing the most recent action : 'Perhaps it will interest you to know that the same kind of work is being prepared for Italy, and I have secured in Milan the help of a widely circulated paper, *Il Secolo*, as well as the efficient patronage of the International Peace Society of Milan. Even Germany will come to the front as soon as M. Colin is able to make the necessary arrangements. The Saxony "living language" teachers write they are ready, and anticipate great results from the system.'

Mr. Stead, as well as M. Mieille, dwells on the possible developments in the shape of vacation meetings of the correspondents, and the establishment between them of lasting personal friendship. As to the national aspect of the matter, there can be no doubt that if the system should become widely adopted, the silken cords of friendly relationship which will thus be stretched from land to land, though they may seem separately of trifling worth, will be likely to form a web of enormous strength in binding the nations together in amity. At all events, the influence of its adoption, in whatever degree, must tend in the direction of peace and good-will.

Leaving, however, to optimistic philosophers and cosmopolitan observers the task of imagining and dilating on some possible colossal development of the scheme into a world-wide eirenicon, we will turn to the special practical interest it has for us and our readers. It has evidently been contemplated by the originator and the promoters of the system that it should be applied to the scholars in intermediate and secondary schools. And in view of the fact that perhaps the majority of our readers are engaged directly with primary instruction, it may seem to have little concern for us; for though French is taught as a specific subject in some of our elementary schools, we are afraid that an infinitesimal proportion of the scholars would be found to have reached a stage when they could undertake letter-writing in French.

There still remain the teachers ; and we are aware from the entries for our French competitions, and from other evidence, that many teachers of elementary schools recognise the value of the acquirement of a modern language as a means of widening their mental culture, of increasing their teaching power, of improving their professional status, and of providing themselves with an unfailing form of recreation. So when we read M. Mieille's essay on his scheme, and Mr. Stead's approving comments, we thought, now here is something which can be turned to account for the good of our readers. For the assistance of teachers who are wishful to improve their knowledge of French no plan can be better. No class of learners can more readily understand its value, nor can any adopt it with more confident hope of a successful result. The community of their pursuits and interests, coupled with the diversity of their conditions, will furnish them with abundance of matter for the kind of 'commerce' to be carried on ; while the insight and sympathy which must spring from the intelligent practice of their profession will enable them to appreciate the difficulties of their 'foreign correspondent,' and the experience gained from the exercise of their common calling will enable them to make their corrections judicious and helpful.

With some such thoughts as these we entered at once into communication with M. Mieille and with Mr. Stead. We placed before them our views that a plan which seemed so reasonable and full of promise for schoolboys and girls might be of equal or greater advantage to teachers, and that it might be possible to adapt the idea of international correspondence so as to make it available for such of our readers as may be studying French.

Both M. Mieille and Mr. Stead welcomed with hearty approval this suggestion to expand the application of the new method for the benefit of teachers. An arrangement has accordingly been made by which, while the applications for the admission of school children to the scheme will be centralised at the office of the *Review of Reviews*, and thence communicated to M. Armand Colin, who is co-operating at Paris with M. Mieille, the applications from teachers will be received at the office of THE PRACTICAL TEACHER, and we undertake, working in concert with Mr. Stead, to send them to the editor of the *Revue Universitaire* and M. Mieille to be dealt with in France. There the correspondents will be paired, and placed in communication with each other, and then the preliminaries for the carrying out of the scheme will be completed.

The object of this paper has been to make known to our readers the details of this interesting movement, and to invite all of them who wish to share in its advantages to send their names and addresses to our office as early as possible. We should add that no fees will be charged. No expenditure will be incurred beyond that of time and care in writing the letters, and the cost of transmitting them through the post.

We trust that the response to this announcement will be worthy of the excellent scheme to which it relates, and of the spirit in which our French *confrères* are promoting it.

The fact that Madame Micille, an Englishwoman and a teacher of English, is interested in the method may, we believe, be taken as a guarantee that our lady readers may depend on finding suitable arrangements made for their correspondence with French lady teachers..

Envelopes should be addressed: Int. Corr. for Teachers. c/o Editor, Office of THE PRACTICAL TEACHER, 33, Paternoster Row, London.

LESSONS FOR CRITICISM CLASSES.

BY C. I. DODD, L.L.A.

Mistress of Method, Day Training Department, The Owens College, Manchester.

SWITZERLAND.

LESSON II.

THE first lesson on Switzerland appeared in the August number of the 'PRACTICAL TEACHER.' It will be remembered that these lessons are to be used in connection with a series of lessons on Longfellow's 'Excelsior,' which appeared in this paper in the early part of last year. The idea of establishing connection between the various studies in the school curriculum is not considered of primary importance in England, but in some other countries this correlation of school studies is carefully worked out. The method followed in these lessons is the method adopted in the Herbartian Schools in Germany. The matter is led up to by a carefully-considered preparation. The actual presentation of the matter consists of a series of questions which demand active thought on the part of the children. Recapitulation is strongly emphasised, and the children are encouraged to sum up the facts and express them in connected narrative. This constitutes the first part of the lesson. The remaining stages—the Association, Formulation, and Application—will be given in the next lesson.

General Aim.—To train the imaginative powers, to help the children to realise the lives of the Swiss people. To encourage thought and correctness of expression.

Apparatus.—Maps. Pictures of Swiss houses and Swiss pastures. Model of Swiss house. Specimens of Swiss wood-carving.

Statement of Aim.—We are going to learn to-day about the houses, the occupations, and the food of the Swiss people.

I.—*Preparation.*

Refer to previous lessons on 'Excelsior' and Switzerland, and ask a few questions.

Where is Switzerland? Point it out on the map.

What do you know about the Swiss mountains?

Where do the glaciers come from?

Where do the Alpine streams come from?

What is the climate of Switzerland in the valleys; on the tops of mountains?

How high up would you expect to find pine forests? Refer to diagram of altitude in first lesson.

How high up the mountain do you think the Alpine village through which the youth passed was situated? Children will be able to give a reasonable answer by referring to diagram of altitude, and recollecting that there were pine forests near the village in the poem.

II.—*Presentation.*

Matter.	*Development of Matter.*
(*a*) The houses in the villages are built of wood, which can be plentifully obtained. **A Swiss village. Houses.** The houses look very picturesque with wide sloping **Roof.** roofs, often kept down with great stones to prevent them being carried off by heavy winds.	Why are houses in England not built of wood? Why is wood so plentiful in the Alpine villages? Refer to the forests, and the difficulties of transporting building material up the mountain slopes. Show picture of Alpine house with stones on the roof.
Most of the houses have a large front door, so large **Front door.** that a cart loaded with hay or vegetables can be driven right through into the hall. This is frequently done, for the people like to have all their cattle safe **Cattle in lower part.** and warm under their roof in winter. The lower part of the house is rarely used by the family. The cows and goats live there in the cattle room. The hay is kept there, and potatoes and fruit are stored there for winter use. Carts, baskets, and garden implements are put away in this hall during the winter. The family live in the rooms above, which are reached by flights of wooden steps from the outside.	Show picture of Swiss house with large front door. Where do our cattle live? Where do we stack away our grain and our hay? Refer to the comfort of an English farm or cottage, as compared with the rough hard life of the Swiss villagers. Show picture of Alpine house, and direct attention to the steps and galleries.
There are usually two flights of steps, one in front, **Steps to upper part.** and one at the side. These steps lead to galleries, which **Galleries.** usually run around three sides of the house. In dry weather the family spend a great deal of time in the galleries. Here the children play, and the father smokes his pipe when he rests in the evening, and the mother washes the crockery, shells the beans, and peels the potatoes. The cutside of these houses are often very **Carving outside the houses.** handsomely carved, and the rails of the gallery and the hand-rail of the steps are also carved. The wood becomes beautifully browned in the sun, and the yellow and brown-timbered houses look very picturesque. Under the roof the **Swallows.** swallows build their nests, and they learn to fly about and above the galleries quite tamely. Underneath the **Stacked wood.** galleries the wood is stacked for winter use. The mother and the	Why can we not spend a great deal of time out of doors in England? Show specimens of Swiss carving. What do we use for fuel in winter? Where do we keep it?

Matter. *Development of Matter.*

children go into the forests and bring home great loads of wood on their back, which

is cut up and piled away under the galleries.

Interior. Inside the houses are very plainly furnished. There are no carpets, curtains, or cushions. The floors are of plain wood, and the chairs are sometimes beautifully carved. The inside of the rooms are rather dark, because the windows are small.

Compare with interior of an English home.

Pottery. The cups, saucers, plates, and jugs are made of pretty blue and brown ware. The cups are highly glazed, and have a handle at each side. There are some beautiful blue cups and plates made at Thun decorated with the Edelweiss. These are cheap, and the people in the villages buy them.

Show Swiss pottery, cups, jugs, and plates of blue and brown ware.

Ceiling covered with ivy. In some of the houses the ceiling is covered with ivy; it is allowed to come in through the windows, and is trained across.

Describe a cottage interior when sheltering from a storm, high up near the storm.

Why should we object to ivy trailing over our ceilings?

The mountain streams, which often tumble down over the stones near the village, is used by the women on washing day.

Washing linen. Two or three women assemble with their soiled clothes, wash it in the stream, and spread it out to dry on the stones, fences, or bushes.

Refer to the 'mountain torrent' in 'Excelsior.'

Compare with English methods of washing.

Recapitulation.

Describe the outside of a Swiss village house.
Why are there great stones on the roof?
Why is the front door so large?
Of what use are the galleries?
Where is the wood stacked? Where does the wood come from?
Describe the inside of one of the Swiss houses.
Where do the women wash the clothes?

SUMMARY FOR BLACKBOARD.

House.
Roof.
Front door.
Lower part.
Galleries.
Carving.
Swallows.
Fuel.
Interior.
Pottery.
Washing Day.

Summing Up.

Require various children to give the whole in connected narrative:—

The houses in the villages are built of wood, and the roofs are often held on by heavy stones. The front door is so large that a cart drawn by oxen can be driven right in. The cattle live in the lower part of the house; potatoes, fruit, and hay are stored here, and all the tools are kept here in winter. The people live in the rooms above, and they reach them by flights of steps from the outside. Galleries run all around the houses, where the children play, the father smokes, and the mother works. The outside of the houses are often very beautifully carved. Underneath the galleries the wood is stacked for the winter fires. Children gather wood in the forest for winter use. The rooms inside are dark, because the windows are small. They are very plain, with bare floors and no carpets or curtains. There are carved chairs, and pretty blue and brown plates, jugs, and cups. The ceiling is often covered with ivy. The women wash the clothes in the mountain streams.

Matter. *Development of Matter.*

Occupation and food of people. Crops. (*b*) The peasants cultivate the land, but they get very scanty crops in the higher regions. The Swiss peasant is very careful of every bit of grass; he climbs up rocky places, where even the goats cannot get, to cut the grass.

How much of the whole of the land is cultivated?
How much covered with forest?
How much rocky and covered with snow?
Refer to previous lesson.
Describe how he cuts bundles of grass, and throws it down the precipice to the place where his cottage is.

Grazing. Grazing is one of the chief occupations. During the winter the cows, goats, and sheep are kept shut up, but when the snow melt the

The cattle go higher for pasture. shepherds take their flocks to the higher pastures where they remain during the summer.

A late spring delays the journey to the Alps, so the people look eagerly to see the little Soldanella which heralds the approach of spring. A cow is decked with flowers and bells, and

The leader. is chosen to lead the herds and flocks. The herdsmen who go with them live on boiled maize and water during the journey. The cattle

Refer to previous lesson on Alpine flowers.

Describe such herdsmen and flocks in the Alps in spring.
What is maize?

Matter.	*Development of Matter.*
are usually very lean, and they look very tired on the journey. When they reach their pastures, they stay there for a month, and then go higher. High up they find the sweet herbs which flavour the milk so deliciously. The herdsmen live in little wooden huts. They milk the cattle, and make butter and cheese. The peasants work in their own homes in the winter at wood-carving, watch-making, and the women spin, weave, and make lace. The boys learn to carve when they are quite young, and the children learn to make toys. The women and children, as well as the men, work very hard.	Refer to Swiss cheese and Swiss condensed milk. Refer to the carving on the outside of the houses. Show carved chamois and cow, and spoon with gentians on the handle carved by little Swiss boys.
The higher Alps.	
Wood carving.	
Women's work. The women often carry heavy burdens on their backs up the steep mountain paths. The children pick berries in the forests, which are taken to market and sold with the butter and cheese. They also gather wood, and carry home great bundles to stack away for winter use.	Refer to the crosses one sometimes sees by the mountain paths, showing how people have sometimes dropped down dead while carrying heavy burdens up hill in the hot sun.
Children's work.	
Food of the people. The food of the Swiss people is very simple. They rarely eat flesh meat. They use many kinds of soups, some of which are made of fruits. Boiled cherries are eaten as vegetables with ham and meat. Cheese, rye bread, soup, and milk form the staple food, with eggs, fruit, and vegetables. A great deal of honey is used. Coffee, bread, and honey are always eaten for breakfast, cheese, rye bread, soup, and vegetables for dinner, only very rarely is meat eaten by the villagers. Eggs, milk, vegetables, and cheese usually form the evening meal. The children usually have rye bread and milk with fruit.	Compare with food in England. What kind of food do people in English villages eat? Do you think they live as plainly as the Swiss people?

Recapitulation.

Why do the peasants get scanty crops?
Why is it difficult in rocky places to cut the grass?
Why do the herdsmen take the cattle to higher pastures in spring?
What flower heralds the coming of spring?
Describe the journey of the cattle and herdsmen.
How does the herdsmen live during summer?
Why is the milk more delicious in the higher pastures?
What occupations do the people follow in summer?
What work do the women and children do?
What kind of food do the people eat?

SUMMARY FOR BLACKBOARD.

Occupations.
Crops.
Grazing.
Higher pastures.
Winter work.
Women and children.
Food.

Summing Up.

Require children to reproduce this head in suitable language:—

Very scanty crops are usually got from the soil. The peasants are careful of every bit of grass, and often climb into dangerous places to cut it. The cattle are shut up in winter, but in the spring when the snows melt, they are taken to higher pastures. The Soldanella tells of the melting of the snows. The cattle are lean and tired during the journey, and the herdsmen has only boiled maize to eat and water to drink. High up are sweet herbs, which give a delicious flavour to the milk. Cheese and butter are made in the little huts on the high pastures. In the winter the peasants carve wood and make watches, the women spin and make lace, the children learn to make toys. The women carry heavy burdens. The children gather berries and wood in the forest. The food is very simple, consisting chiefly of rye bread, cheese, goats' milk, fruit, and honey.

NEW DICTATION TESTS.

STANDARD IV.

Suitable for 'Unseen Tests' in Reading also.

No. 402.

A GREAT writer who was rich, popular, and prosperous, who had all the pleasure and happiness which health and wealth, honours and friends can give, yet said that his greatest happiness had been derived from reading. We do our best to educate our children; we teach them to read, and try to give them a love for reading. Why? Because we believe that no one can study without being the better for it; that it tends to make the man the better workman, and the workman the better man.

No. 403.

SWIMMING should form a part of every child's school training as much as reading and writing. People would have greater confidence in the water if they realised that the human body weighs one pound in it, and that a chair will carry two persons—that is to say, it will keep the head above water, which is all that is necessary when it is a question of life or death. One finger even placed upon a stool or board will keep the head above water, whilst the two feet and the other hand may be used as paddles to propel towards the shore.

No. 404.

THE German Emperor frequently has a week's retirement from the bustling world, and hides within the depths of a forest, where a small cottage is his abode, nestled beneath a splendid oak, with forests around him for miles. There, while the dew is on the forest, he starts forth gun in hand, with a brace of dogs and a sturdy forester, and at four o'clock he is at the best spot for sport. Then his Majesty shoots till eleven, when he wends his way homewards, eats and sleeps awhile, after which he puts his signature to all the documents which require it.

No. 405.

COWS in Norway have been credited with the power of extracting sustenance from stones which travellers in that country will have seen them licking. A more substantial diet is found for them in the winter in some parts of the country, where provender of all kinds is scarce, in the shape of heads of the codfish, which are pounded into a mash. The milk of cows so fed tastes strongly of cod-liver oil, and cannot be pleasant to drink, yet with all its unpleasantness it may be very valuable for consumptive patients.

No. 406.

MARCH is usually well begun before rooks make any serious attempt to set their houses in order. They set to work at the very

stormiest and most changeable of seasons, when the labour of bringing home new sticks, of repairing the nests, of feeding their broods, must be increased a hundredfold by the wind and by the swaying of the trees. The building time is the time of clamour.

No. 407.

THE reason officers do not constantly wear uniform is that once, in a time of absurd irritation that this country should possess so large a standing army, the Duke of Wellington ordered all officers to wear plain clothes when not on duty, so that no one could point to the well-dressed defenders of our country and tremble at their numbers.

No. 408.

To cut a track through the high and precipitous mountains of North Queensland, the men are obliged to be hung in chains, and, notwithstanding this precaution, about fifty have lost their lives by losing their footing, and being dashed down a thousand feet into the chasms below. Twice the attempt to form this roadway has all but been abandoned, but the contractors, with characteristic pluck, have addressed themselves to the work again.

No. 409.

IN some countries dates form not only the principal food, but drink, clothing, timber, and shelter. To the Hindoo especially is the tree valuable, for it means to him nearly all the necessaries of life. A liquor, resembling wine, is made from the fruit. There is a soft pith in the stem, which, with the young leaves, is eaten as a vegetable, and is called palm cabbage.

No. 410.

THE spotted flycatcher is not particular as to position, its nest being placed in trees trained up a wall, in barns, greenhouses, in gas-lamps, and sometimes even in deserted thrushes' nests. It is recorded that one nest was built on a garden hoe that hung on a nail in a tool-shed; the nest was taken off when the hoe was required, and was laid on a shelf; then it was returned to its original position as soon as the hoe was hung up again, the parent birds seeming to favour the arrangement.

No. 411.

STEAMERS travelling through the Suez Canal at night must hire the electric light. The cost of the light, the engine, and two men to attend is £10, the steam for working the engine being provided by the ship. Each vessel has two lights—one hangs right forward over the bows of the ship to show the road, and the other is suspended about half way up the foremast, or, rather, the after-part of the foremast.

No. 412.

IT is predicted that milk will soon be imported from Australia in frozen blocks and retailed like ice. At present, most practical men, while admitting that it could be done—for frozen milk on shipboard is not a new thing—yet consider that the operation of thawing would involve too much trouble and risk. Frozen milk would have to be used speedily, as immediately it attained its normal temperature it would begin to 'turn.'

No. 413.

FACTS are to the mind what food is to the body, and on the due digestion of facts depends the strength and wisdom of the one, just as vigour and health depend on the other. The wisest in council, the ablest in debate, and the most agreeable companion in the commerce of human life, is that man who has assimilated to his understanding the greatest number of facts.

No. 414.

THE diving apparatus is one of the latest objects to which the telephone has been applied. A sheet of copper is used in place of one of the glasses in the helmet, and to this a telephone is fixed, so that the diver, when at the bottom of the sea, has only to slightly turn his head in order to report what he sees or to receive instructions from above.

No. 415.

WHEN a white elephant dies the hairs of its tail are preserved as sacred relics, and the body is buried with royal honours. A hair from its tail is looked upon as one of the most precious presents by which a king can show his favour to anyone worthy of it. They are set in handles of gold and precious stones, and one of these tufts was considered a gift of sufficient importance to be sent to the Queen of England.

No. 416.

THERE is always someone to smile at, somebody to give your chair to, somebody to whom a book, a flower, or even an old paper, would be a boon. These small attentions will open the way to confidence, will make it possible that in need these friends will give you opportunities to help them, which, unless you had shown thoughtfulness and regard for them, they could never have done. A quiet, sympathetic look or smile many a time unbars a heart that needs help which you can give.

No. 417.

THIS mortal life,—a fleeting thing,—
When most we love, it swiftest flies:
It passes like a shade and dies;
And while it flaps its busy wing,
It scatters every mist that lies
Round human hopes;—all air and dew,—
I told thee so,—I told thee so,—
And oh, my soul! the tale was true.

STANDARDS V.—VII., AND 1ST & 2ND YEAR P.T's.
Suitable for 'Unseen Tests' in Reading also.

No. 340.

IF I must choose between the aristocracy of wealth and the aristocracy of birth, I choose the latter. I find that those who have been born to high position wear their honours with more ease and less ostentation than those who come upon them suddenly. So far as I have this summer seen the homes and habits of the aristocrats of England, I find them plain in their manners, higher cultured as to their minds, and many of them intensely Christian in their feelings. There is more strut and pretension of manner in many an American constable, or alderman, or legislator, than you will find in the halls and castles of the nobility of England. One great reason for this is that a man born to great position in Great Britain is not afraid of losing it. (H.M.I.'s Test.)

No. 341.

UNLESS there be some sympathy with suffering, there will be nothing done for its relief, and the ties of human brotherhood will be quickly sundered. If it is a blessing that we are unable to feel the full force of another's sorrow, it is no less a blessing that we have the capacity of feeling a part of it. And this capacity usually needs development rather than restraint. For a few who may grieve unwarrantably for their fancied insensibility there are multitudes who are sadly deficient in sympathy, and never grieve at all about it. It should never be forgotten that all social happiness, all mutual benefactions, and all true benevolence, are founded on the presence of sympathy.

No. 342.

THE reason why authors are required to write on one side of the paper is that on occasions, when time is pressing for a forme or page of type to be made up (particularly on a daily paper), a page of the manuscript is often cut up into several pieces and given to as many compositors, which could not be done were both sides written on; it insures uniformity, and so prevents errors; it saves the time of the compositor, as he is not compelled to turn the sheet over; and it protects editors, proof-readers, and printers from the blurred writing resulting from the use of thin paper, which is so harassing to the mind, and destructive to the eyesight.

No. 343.

AMONG the oft-quoted maxims in our language there is none finer, or more replete with sterling truth, than that which often falls so lightly from men's lips: 'Where there is a will there is a way.' No doubt there are mits to human capability in all human affairs; in every sphere of activity men may meet with obstacles which even the utmost energy cannot overcome. Almost every man is more or less the victim of circumstances, which sometimes operate so powerfully that it is impossible to crush his way through them. But the frequency with which such occasions occur is greatly over-estimated; and the fact that mountains so often dwindle into molehills when we once resolutely determine to cross them, shows that the old Saxon saw is still true generally, and that he who intensely wills to do a thing will find a way.

No. 344.

THE Church is the oldest institution in this country. It alone has stood by the grave of old worlds, and by the cradle of new, bidding order arise out of confusion. It alone has survived the fall of dynasties and the rise of constitutions, unchanged and unchangeable amid the vicissitudes of centuries—the grand central fact round which English history has revolved. By its side the English nation is a modern growth, and kingships and dignities are things of to-day. The spiritual pedigree of its bishops spans by their uninterrupted succession the nineteen centuries of the Christian era. It has been the chosen instrument for extending the spiritual blessings and glorious hopes of Christianity among barbarous and ignorant peoples. Its spiritual order rose above the turmoil of the world, subduing to silence those whom its sacred teaching failed to attract.

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SCIENCE FROM THE LOG OF THE 'FRAM.'

BEING A FORETASTE OF NANSEN'S SCIENTIFIC DISCOVERIES.

TEACHERS whose proud privilege it is to write F.R.G.S. after their names, never felt more loyal to the Society denoted by the three last of these mystic letters than when, in response to the invitation of Sir Clements Markham, they, on the evening of Feb. 8th, gathered at the Albert Hall in their thousands to do honour to the gallant head of the ever-to-be-remembered *Fram* expedition. Did not inexorable space conditions forbid, one would fain make some attempt at describing the historic scene which, when the lights were turned down, and, in all but total darkness, the lifelike representations of Arctic scenery were thrown upon the 40 ft. screen, became intensely weird and almost dramatic. But the tale has already been told how Sir Clements Markham paid well-deserved tribute to the prowess of the *Fram* and the '*Fram* fellows,' how Sir Leopold MacClintock, out of the store of his remembrance, bore testimony to the terrors of hyperborean regions, and extolled the all-daring fortitude that had vanquished them, and how Sir George Nares, also of Arctic fame, himself eulogised Nansen and all his brave fellows—how with grace and evident feeling the Prince of Wales presented the special gold medal to Dr. Nansen, accompanying the present with a hand-grip that evidently touched the worthy doctor even more than the sympathetic words had done. So, being reminded that this article is to deal with the *Fram* expedition and science, we forbear further description of the function and proceed to our task.

Dr. Nansen was very careful to point out that, until a complete examination of the materials, that have been brought home, has been accomplished, it will obviously be impossible to estimate the value of his work from a scientific, and especially from a research standpoint. Consequently the details here given must be regarded as the more superficial pieces of information requiring no time for elucidation, and constituting a mere preliminary to the main body of the work, which will take months and perhaps years to digest and describe.

Chelyuskin Peninsula.—Here was observed a striking proof of the fact that the ice cap that covered Europe north of London did not, as is usually believed, fall short of Siberia, as will be gathered from the Doctor's own words: 'In the course of the voyage along the coast of Siberia, abundant evidence of the former existence of a great ice-sheet was forthcoming, and the appearance could not be explained by reference to local glaciers. For instance, the land on the east side of the Chelyuskin peninsula, where I went out reindeer shooting one day, was a very undulating clay plain, *over which was strewn a multitude of big boulders of various rocks*, which could not be easily explained as due to local glacier action. The fact that I found an indication of stratification in various places, can hardly be regarded as an argument against its moraine-like character, as there are incontestable moraines in the south of Norway, which are distinctly stratified.'

The drift that carried the 'Fram.'—The existence of this drift is sufficiently proved by the journey of the 'Fram,' although it was considered a creature of Nansen's brain when first mooted by the explorer at the meeting of the Royal Geographical Society, when Dr. Nansen, prior to starting, unfolded his plans. Other evidence of the validity of this current was not wanting, as will appear from the following: 'During our journey we had abundant evidence of the reality of the ice-drift across the polar sea, on the faith of which the expedition had been planned. Earthy matter was found on the ice as far north as 86°, and driftwood also. I remember, one day, far north, during our journey (Johansen and myself) over the ice, our astonishment *at seeing a large piece of timber projecting from the ice;* it hailed, perhaps, from the interior of Siberia, and was on its way to the Eskimo of Greenland. The only thing we could do was to cut our initials on it, write the date and latitude.'

What Causes the Drift.—'The cause of the drift is, first of all, the wind which generally blows from the Siberian Sea to the North Atlantic Ocean. As the wind varies, the drift varies also; but it was always stronger when towards the north and west, and feeblest when towards the south and east. Most progress was made in the winter, least in summer, when southern winds were relatively common. I believe that when the records are worked up, it will be possible to demonstrate that there was a slight current in the water under the ice setting in the prevailing direction, or perhaps a little to the northward of the prevailing wind. The massive ice cap, which many polar explorers have believed to cover the polar area, has been shattered; instead of it we have the *ever wandering ice-fields*, like a link in the eternal round of Nature.'

The Nature of the Polar Basin.—In the opinion of Nansen, the great achievement of the expedition so far as concerns geography is the new knowledge bearing upon this point. It has been surmised that the polar area is covered (1) by a shallow sea, or (2) by land masses more or less extensive. Nansen has conclusively proved that deep water lies in this region. The evidence upon which this statement rests will be understood from that portion of Dr. Nansen's lecture which is here reproduced. 'Formerly it had been supposed to be a comparatively shallow sea, a view in which I had concurred. We found that the sea in 79° N., north of the Siberian Islands, suddenly became deeper than 100 fathoms and sank to depths of 1,800 to 2,000 fathoms, and such depths were found continuously by the *Fram* during her entire drift north-west and west to as far as Spitzbergen. *The polar basin thus appears to be a deep sea*, forming a continuation northwards and eastwards of the depression in the North Atlantic Ocean. This deep sea probably extends further east than the New Siberian Islands, as the *Jeannette* found the depth increasing every time the drift carried her to the northward.'

Little Land can lie on the Asiatic Side of the Pole, because the ice was found to be drifting with greater instead of less freedom as Nansen and Johansen progressed further north on their memorable sledge excursion.

Considerable Land on the American Side.—This is Nansen's opinion because of the land masses already found to exist. It is probable that the archipelago nature of the regions to the north of America is continued nearer to the pole.

How the Ice Grows.—The great thickness of the ice is not due to the direct action of frost, but to the heaping up of mass upon mass. A thickness of about four metres is thought by Dr. Nansen to represent the maximum direct effect of frost.

Ice Pressure.—This is due mainly to *tidal action*, especially on the margin of the ice-fields, where 'the periods of great pressure occurred regularly about full moon and new moon, the former being the greater.' The worst ice pressures experienced by the *Fram* were when the wind suddenly changed after having been long steady.

The Temperature of the Water.—Under this head some very interesting information is supplied, the evidence in favour of *warm current in polar seas* being entirely conclusive. 'Even as far east as the sea north of the New Siberian Islands I found undoubted traces of a *warm current*. The *surface water* of the entire polar basin is doubtless very cold, between −1·5° C. and −1·6° C., the freezing point of sea water. Beneath this cold layer, at depths of 200 metres, I *suddenly found warm water*, the temperature rising to ·5° C., or even to ·8° C. At a greater depth the temperature varied somewhat, but remained nearly constant to a depth of 400 or 500 metres, after which it slowly sank until the bottom was reached, never, however, getting so low as the surface temperature, viz., −1·5° C. to −1·6° C.'

The Atmosphere.—The air temperatures were not so low as in Siberia, thus instancing signally the benign influence of a water area as opposed to a land area, as is seen universally in continental and insular climates. 'The minimum we found, viz. −53° C., is not immoderately low, as −68° C. has been recorded at Verkhoyansk. In the far north the *winds* were not very strong, seldom amounting to a gale; but this climate entirely changed on the westward journey, and in the winter quarters in Franz Josef Land a succession of furious gales howled round us continually.'

Life Forms.—It will be hardly surprising, to those who know how adaptable are the species, to learn that life forms were abundant in the highest latitudes reached. 'Animal life was abundantly observed, both in the form of very small marine organisms, especially **crustacea**, and larger creatures. **Narwhal** were seen in shoals up to nearly 85° N., and **seals** were also frequently seen in summer. **Bears** were shot north of 84° N., and **fox** tracks were seen in 85° N. Near Hvittenland, east of Franz Josef Land, the probable nesting place of the **rosy gull** was found. The fresh-water ponds on the ice in summer swarmed with **diatoms** and other **algæ**.'

Sea Bottom.—Ooze collection and examination was not neglected by the scientific staff of the *Fram*, and here again valuable information rewarded their efforts. 'The microscopic examination of the numerous specimens of sea bottoms obtained by our soundings proved that they differ essentially from the examples taken from the North Atlantic Ocean, as they are wanting in the characteristic organisms. The arctic sea water was found to be particularly **deficient in carbonates**, and appears to consist chiefly of mineral components.' Of course, this part of the work will be liable to great modification upon further microscopic and chemical examination.

The Aurora.—Beautiful aurora effects were thrown upon the screen, and much interest was aroused by Dr. Nansen's appreciative description of the marvels of arctic scenery and auroral brilliance. Said the lecturer: 'There were exceptional opportunities of observing the aurora, and amongst other curious phenomena the heavens were often shrouded with a light luminous veil, through which it was difficult to see the Milky Way.' The aurora was found to be much more common in very high latitudes than it was formerly supposed to be.

Accuracy of Existing Maps.—In two particulars, at least, Dr. Nansen has modified the map of the region traversed by him in the course of his journey. In the first place, to the westward of the Taimyr Peninsula, the *Fram* came upon a group of islands, small, but numerous, which are not to be found in any existing map. To this archipelago the explorer gave the name Nordenskiold Islands, in honour of the man who 'showed us the way along the coast of Asia.' Secondly, in returning from his sledge journey northwards with Johansen, Nansen was greatly puzzled as to the identity of the land which they made after their truly wonderful journey. The land was Franz Josef Land, which is inaccurately mapped by Parger, who, adds Dr. Nansen, was probably misled by mistaking 'banks of mist upon which the sun was shining for a great glacier-covered land—a mistake,' added the lecturer, 'which I, in common with all arctic explorers, have made more than once. For the rest, 'Dr. Copeland is now engaged in recalculating Parger's positions, and finds his work particularly good.'

This incomplete sketch of the first instalment of the scientific achievements of the hardy Norseman and his devoted band of *Fram* fellows will serve to whet the appetite of physiographists for the more solid bill of fare which is to bear witness to the zeal and efficiency of the experts whose privilege it was to participate in the epoch-making drift of the gallant little *Fram*. That Nansen is as gifted as he is bold and persevering, must have been the opinion of all who listened to the plain, unvarnished tale from which the above details as to the new light on things hyperborean are extracted. Certainly it was and is the opinion of the writer.

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

First Class Honoursman in Chemistry (Science and Art Department), Head Master, Finchley Organised Science School, and Lecturer therein on Chemistry.

Purity of Acetylene.—It has been found by MM. Manœuvrier and Fournier that acetylene obtained by the action of water on calcium carbide is not pure, only 74 per cent. of it being absorbed by the ammonio-chloride of copper. After purification the gas is said to lose its characteristic alliaceous scent, though still possessing a strong, penetrating odour.

Silver Hydride.—Messrs. E. J. Bartlett and W. F. Rice describe in the American *Chemical Journal* the successful preparation of silver hydride, which they prepared by precipitating a dilute solution of silver nitrate with dilute hypophosphorus acid. The product is rapidly filtered off and washed, when it forms spongy black flakes that are not decomposed by water.

Chromium Silicide.—M. G. de Chalmot shows that not only does chromium form a silicide of the formula $SiCr_2$, the compound obtained by Moissan, but also a compound Si_2Cr_3, formed by heating chromium sesquioxide, charcoal, and silica in an electric arc furnace.

Metallic Carbides.—To the number of metallic carbides produced by Moissan in his electrical furnace must now be added the carbide of lanthanum—LnC_2. Like most carbides, it is decomposed by water, and yields acetylene 71 per cent., methane 27 per cent., a little ethylene and small quantities of liquid and solid hydrocarbons, thus closely resembling the carbide of cerium.

The Wide Dissemination of the Rarer Metals.—Professor Hartley, at a recent meeting of the Chemical Society, made known the results of some determinations 'on the wide dissemination of some of the rarer elements and the mode of their association in common ores and minerals.' One hundred and seventy specimens had been subjected to spectrum analysis, half a gram of each, finely powdered, having been heated in the oxy-hydrogen flame.

The author remarks that the following elements and their compounds yield spectra under these conditions which are easily observed.

(*a*) In very small quantity:—Na, Ca, Pb, Ni, K, Se, Bi, Cu, Ba, Cr, Rb, Ga, Mn, Ag, In, Fe, Cs, Te, Co.

(*b*) In small quantity:—Li, Au, Cd, Sn, Sb.

(*c*) In such quantity as to indicate that the substance is a principal constituent of the mineral:—Be, B, Di, Te, Rb, Mg, Al, S, Pd, Zn, Cl, Se, Ru.

The following is a summary of the chief results:—

Clay Iron-stones and Black-band Ores.—Six specimens examined. All contain Na, K, Cu, Ca, and Mn; 47 contain Ag, 32 Pb, 21 Ga, 13 Ni, 12 Cr, 1 Sr, 1 Th. Probably all contain Rb, but it is difficult to recognise owing to the multitude of iron lines. Three specimens undoubtedly contain it.

Brown Haematites.—Six specimens examined. All contain Na, K, Cu, Ca, and Mn; 5 Ag, 5 Pb, 5 Ni, 3 Cr, 2 Ga, 2 Th, 1 In. Probably all Rb, certainly one does.

Limonites.—Five specimens examined. All contain Na, K, Ag, Mn, and ? Rb; 4 Ca, 4 Pb, 3 Cu, 3 Ni, 1 Ga, 1 Th, 1 Cr.

Red Haematite.—Eighteen specimens examined. All contain Na and K; 17 Cu, 14 Mn, 13 Ag, 12 Pb, 12 Cu, 3 Ga, 3 Ind, 3 Ni, 2 Cr, 1 Rb, 1 Th.

Magnetites.—Seven specimens examined. All contain Na, K, Ca, Ag, Cu, Ga, Pb, and Mn ; 4 ? Rb, 2 Ni, 1 In.

Siderites.—Five specimens examined. All contain Na, K, Cu, Ag, Ca, In, and Mn ; 3 Pb, 1 Rb, 1 Ga, 1 Co, 1 Ni, 1 Bi.

Aluminous Minerals, such as Bauxite.—Seventeen specimens examined. All contain Na, K, Cu, Ca, Fe, H ; 16 Ga ; 15 Cr, 13 Ni, 12 Mn, 9 Ag, 3 Pb, 2 Rb.

Manganese Ores and Minerals.—Eleven specimens examined. All contain Na, K, Cu, Fe, Ca ; 10 Ag, 5 Rb, 5 Ni, 4 Ga, 4 Pb, 4 Sr, 2 Ba, 1 Ind, 1 Co.

Blendes.—Fourteen specimens examined. All contain Na, Cu, Ag, and Fe ; 13 K, 12 Ga, 12 Pb, 10 Ag, 10 Mn, 9 In, 7 Cd, 4 Th, 2 Ni, 1 Cr.

Ni and Co Ores.—Nine specimens examined. All contain Na, K, Cu, Ca, Fe, and Ni ; 6 Co, 6 Pb, 4 Cr, 3 Ag, 1 Ba, 1 Sr.

Tin Ores.—Five specimens examined. All contain Na, In, and Fe ; 4 K, 3 Cu, 3 Ca, 3 Pb, 2 Ag, 2 Mn.

Galenas.—Eight specimens examined. All contain Na, K, Cu, Ag, and Fe ; 4 Mn, 3 Ca.

Pyrites.—Thirteen specimens examined. All contain Na, K, Cu, Ag, Ca, and Fe ; 11 Pb, 10 Mn, 5 In, 5 Th, 5 Ni, 1 Ga,

Out of 168 ores and minerals examined :—Ga 68, In 30, Th 17, Rb ? 70, but unquestionably in 13. All the carbonates of Fe and all the tin ores contain In. With one single exception, all the bauxites contain Ga.

Ag, Cu, Ca, K, and Na are very widely disseminated through all ores and minerals. The authors draw deductions as to the formation of beds and lodes of ore from the following facts, which they claim to be established :—(1) Certain groups of ores are pervaded by certain other groups as impurities; (2) that the rare metals, more especially Rb, Ga, In, and Th, are associated with the same groups of minerals, and also with allied groups.

It is easy to trace the association of similarly constituted compounds to their connection with elements related to each other, as determined by the periodic system of classification. These compounds have certain properties in common, distinctive of the groups of elements and compounds to which they belong ; hence in a given course of chemical changes, similar compounds are formed and thrown together by precipitation, or otherwise all the minerals mentioned have undoubtedly had an aqueous origin.

The presence of the alkali metals in all the specimens, but in variable proportion, has a special significance.

In the analyses of many different precipitates obtained both in neutral and in strongly acid solutions, the alkali metals have been found in combination with the precipitated substance. It has long been known that manganese, aluminium, and iron in the state of hydroxides, combine with more or less of the alkalis, but in great measure such combinations have been disregarded.—*Journal of the Chemical Society.*

Combination of Argon with Helium.—Mr. Bertholet announces that he has brought about the combination of these two newly found elements by means of the electric current. The apparatus used is exceedingly sensitive and able to discriminate to $\frac{1}{180}$ of a cubic centimetre in volume. The reaction of the two gases is very slow, so that Mr. Bertholet, although he prolonged his experiment for 180 hours, did not allow sufficient time for complete combination. He calculates that 400 hours would be necessary in order that the reaction might be fully accomplished. On account of the small volumes operated upon, Mr. Bertholet does not regard his experiment as entirely satisfactory, but enough was done to warrant him in believing that, granted sufficient of the gas to operate upon, a simple binary compound of the two elements would result.

Specific Heats.—It is admitted that the simple gases possess identical specific heats ; now gases must, from this point of view, be divided into four diverse classes.

The first class comprises oxygen, hydrogen, and nitrogen, the specific heat of which at constant pressure is 6·8, and at constant volume 4·8. The difference corresponds to the work done in expansion. The ratio of the two specific heats is 1·41.

A second group comprises argon, helium, mercury (and without doubt cadmium), for which the ratio of the two specific heats is 1·66.

A third group comprises chlorine, bromine, and iodine, the specific heats of which are 8·6 and 6·6, corresponding to a ratio of 1·5, a ratio that is corroborated by certain experiments upon the velocity of sound. This group is, to some extent, intermediary, because from 1600° C. to 1800° C. the density of these gases diminishes, so that the law of compressibility no longer applies.

The last group comprises phosphorus, the specific heats of which at constant pressure and volume are respectively 15·4 and 11·4 with a ratio of 1·17.—*La Nature.*

Atomic Weight of Magnesium.—Professors Richards and Parker have determined afresh the atomic weight of this element, the atomic weight of which was found by M. Marignac in 1894 to be 24·37. This has been entirely confirmed by Professors Richards and Parker, whose method was as follows : Magnesium chloride was prepared with great care so as to ensure a pure specimen, the double chloride of aluminium and magnesium being to this end heated in a current of dry hydrochloric acid; the chloride was transferred to a weighed tube without exposure to moisture, and was precipitated by the addition of silver nitrate. The results of four series of experiments very closely agreeing give as an average the number 24·362 as the atomic weight of magnesium, taking that of oxygen as 16 ; or, taking oxygen as 15·88, an atomic weight of 24·179.

NOTES ON PHYSIOGRAPHY.

Shade Temperatures.—At the annual meeting of the Royal Meteorological Society, the President (Mr. E. Mawley) gave an address on this important physiographical subject. In determining the temperature of the air, or the shade temperature, as it is termed, Mr. Mawley stated that for many years it had been customary to use open screens ; but, in 1864, Mr. T. Stevenson invented a closed screen with louvred sides, which in 1883 was greatly improved by a Committee of the Meteorological Society, with which the President has lately made experiments which prove that, not only is the Stevenson screen capable of giving the nearest to the true air temperatures, but also such results are given as can more strictly be compared with temperatures taken in a similar screen with different surroundings.

Huge Rock Pinnacle in the South-West Pacific.—Careful soundings made by Commander Balfour in the *Penguin* have revealed the presence of a huge pinnacle of rock, reaching within 837 fathoms of the surface, and sinking at the base to 1,800 or 1,900 fathoms. The soundings showed at the highest point 85 per cent. of carbonate of lime and 65 per cent. at the base. It is believed, from the nature of the fragments found in the soundings, that the rock is of volcanic origin, and that it is slowly undergoing a process of disintegration under the action of the sea.

Physical Condition of the Ocean to the East of the Australian Continent.—Dr. Murray, at the January meeting of the Royal Society of Edinburgh, said that great additions had by careful Government surveys been made to our knowledge of this part of the ocean. He had examined over 2,000 soundings sent to him from time to time by the hydrographer. He referred to the fact that here the **deepest ocean sounding on record** had been taken. Before this, 4,600 fathoms had been found off the coast of Japan, and an American boat had sounded a depth of 4,670 fathoms ; but Commander Balfour had paid out line to a depth of 5,155 **fathoms east of the Kermadec Islands.** From this and other data Dr. Murray entertains no doubt that we have here the remains of a **sunken continent.**

The Murray Theory of Coral Reef Formation.—Dr. Murray cites a signal corroboration of his theory that coral reefs are best explained by considering the coral as formed upon sinking areas. In this region coral is more plentiful than anywhere else, the conditions, especially as regards the temperature of the ocean, being most favourable. Throughout the year the temperature of the ocean never sinks below 70°F. Falcon Island, which at one time had an area of several miles and was from 250 to 290 feet high, is now but a mere black line upon the surface surrounded by shoals.

The Sea Bottom.—In the centre of the area examined the bottom temperature at 1,500 fathoms was 36°F., but was colder in the deep and wide gullies. The principal constituent of the oozes collected was carbonate of lime, which at depths less than 100 fathoms formed from 80 to 90 per cent. of the whole. For depths down to 2,400 fathoms the percentage was 50 to 70. It decreases rapidly with decrease of depth, and in the lower soundings no trace whatever of this substance was found. Further south there was much detrital matter, which was more chalk-like in appearance. Nearly every kind of ooze was represented, though there was but little of the kind known as the Regillarian.

Suggestion as to the Origin of the Martian Canals.—At the December meeting of the Royal Society of Dublin, Dr. J. Joly, F.R.S., put forward the following suggestion as to the origin of the canals of Mars:—'The formation of the principal curved lines and double canals observed by Prof. Schiaparelli and Mr. Lowell is referred by the author to the disturbances of the crust of the planet, produced by the gravitational attraction of small satellites, in past times rotating close to the planet. It is shown that a satellite as small even as Phobos, if rotating some 50 or 60 miles above the surface, would produce very appreciable stresses in the surface of the crust of the planet. Integrating the horizontal component of the gravitational pull outwards from beneath the satellite, a ring of maximum

stress defined as the base of a cone having the satellite as its summit and a semi-angle of 71° is obtained. If the satellite is moving relatively to the surface of the planet, tangents to this circle in the direction of motion define lines of probable rupture. There is also probable development of a central line of weakness vertically beneath the satellite's line of motion. These disturbances probably give rise to mountain ranges—possibly of small altitude—which constitute the "double canals" and lines observed on the surface. Mountain ranges more readily explain the seasonal changes in visibility than any other hypothesis as to their nature. Satellites rotating so close to the surface will probably exist only for a score of years, or thereabouts, between such limits of distance as 70 to 50 miles, when, sinking deeper into the planet's atmosphere, their energy will be rapidly absorbed, and they will fall in; assuming, as most probable, that the day is longer than the month, or that the satellite's motion is retrograde. The intersection of the radius vector of the satellite with the surface of the planet will describe certain curves, the span of which upon the equator will depend upon the rates of relative angular velocity of planet and satellite. Given the span and rise, the curvature is completely defined. The curves upon Mr. Lowell's map and those given by Professor Schiaparelli are apparently in close agreement with the theoretical curves. They are not great circles. It is shown that nodal lines will give rise to centres of radiating lines. The location of Mars' orbit so close to the ring of asteroids—some of which are known to come within his mean distance from the sun—is considered to render *à priori* probable the assumption that Mars has throughout the past, at intervals, picked up satellites which, after describing a spiral path round him, ultimately fell in. Phobos is, —according to lunar theory—probably in the way to do so at some future time. It is shown that a small solid satellite, even if composed of no stronger material than basalt, will be amply stable under the unbalanced gravitational and centrifugal forces to which it will be subject when close to Mars' surface.'—*Nature.*

Recent Rainfall.—The rainfall for the week ending Feb. 6th greatly exceeded the mean for England and the south of Ireland. In some cases the fall was three or four times as great as the average. On the other hand, over Scotland and the North of Ireland a less than normal rainfall was experienced. Since the beginning of the year the average for the greater part of England is an inch above normal, whereas in North and West Scotland there is a deficiency of about four inches.

Rain-making.—Dr. W. Hertschel has outlined a mode of procedure in rain-making which is very interesting to meteorologists. He proposes to utilise the effects of statical electricity in forming rain-drops. A balloon is to be electrified by means of a cable connected with a dynamo, thus reversing the well known procedure of Benjamin Franklin. Dr. Hertschel contends that in this way the rainfall may be increased, and perhaps decreased, at will.

Fog Prevention.—It has been shown by Professor Aitkin that moisture condensation to form fog depends upon the presence of dust particles in the atmosphere, hence the removal of the dust nuclei would result in the lifting of the fog. This can be done by electrification, and perhaps the future may see the electrician called in when fog threatens in order to stave off the dismal horror.

Man in the Glacial Period.—Dr. E. W. Claypole reports the finding of a ground stone axe at a depth of 22 ft. in the drift of North Central Ohio. The axe, which was partially embedded in the boulder clay, lay in a bed of coarse gravel a foot thick, above which was a 13 ft. thick bed of silt; interbedded in this were streaks of sand, and finally there were superimposed 8 ft. of clay. Dr. Claypole regards these beds as having been 'the deposits of the torrents of water and the still ponds which characterise the flow from the front of a glacier in a flat country'; he supports his statement by a description of the district, and he also enters into the *bona-fides* of the discoverer of the implement. The axe was made of a hard, banded green slate, but it was oxidised throughout, owing to the sulphurous nature of the water in the gravel; the concentric lines of colour (limonite stains) parallel to the contour of the implement prove that the change has taken place since it left the hand of the Neolithic maker, and the rotten state of the stone shows that it must have been imbedded in the gravel for a very long time. 'It is always a difficult matter to sift the evidence of such finds, but this appears to be worthy of critical examination.'—*Nature.*

Owing to the illness of Dr. Overend, we are unable to insert the usual 'Notes on Physiology.' We can, however, promise our readers a double supply in our next number.

MAGNETISM AND ELECTRICITY.

BY EDWIN EDSER, A.R.C.S.,

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POTENTIAL.—If a body be moved in opposition to a force acting upon it, the potential energy of the body is increased, the value of the increase being equal to the work that has been done. Thus, if a stone is raised through a height h, the increase of its potential energy $= mgh$, where m = the mass of the stone which is moved in opposition to the uniform force of gravity $= mg$.

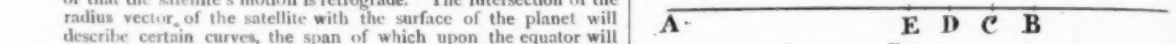

FIG. 1.

Let us suppose that a quantity of electricity equal to $+q$ units is condensed at a point A (Fig. 1). If a + unit of electricity is brought up towards A, since it will be continually subjected during this process to a force tending to move it in an opposite direction, work will be done, and the potential energy of the + unit will be increased. The case is, however, not so simple as that of the stone raised against the force of gravity, for here the magnitude of the force increases as the charge is brought nearer to A.

When the + unit is at B, the force acting upon it in the direction

$$\overrightarrow{AB} = \frac{q \times 1}{r_1^2},$$

where r_1 = distance AB. Let C be a point nearer to A than B, but so close to B that the forces acting on the + unit at C and B may be considered to be equal. Let distance AC $= r_2$. Then the force acting on the + unit as it is moved from B to C may be written $\frac{q}{r_1 r_2}$, since $r_1 = r_2$ approximately. The work done in bringing the + unit of electricity from B to C

$$= \frac{q}{r_1 r_2} \times \text{distance BC} = \frac{q}{r_1 r_2} \times (r_1 - r_2) = \frac{q}{r_2} - \frac{q}{r_1}.$$

Similarly, if r_3 = distance AD, r_4 = distance AE, work done in bringing + unit from C to D $= \frac{q}{r_3} - \frac{q}{r_2}$, and work done between D and E $= \frac{q}{r_4} - \frac{q}{r_3}$.

Hence work done in bringing + unit from B to E = sum of the above elements of work

$$= \frac{q}{r_4} - \frac{q}{r_3} + \frac{q}{r_3} - \frac{q}{r_2} + \frac{q}{r_2} - \frac{q}{r_1} = \frac{q}{r_4} - \frac{q}{r_1}.$$

Also this will be equal to the increase of the potential energy of the + unit when moved from B to E. It is spoken of shortly as *the difference of potential between the points* B *and* E.

If $-q$ units were condensed at A, the force acting on a + unit would be towards A, and the work done in bringing it from B to E would be negative, *i.e.* the potential energy of the + unit would be decreased, or the difference of potential between B and E would be negative.

From the above, it can easily be seen that + electricity always tends to move from points at higher to those at lower potential.

Also all points on a conductor must be at the same potential. For, if not, electricity would at once flow from the points at higher to those at lower potential, till the potential of the whole was equalised.

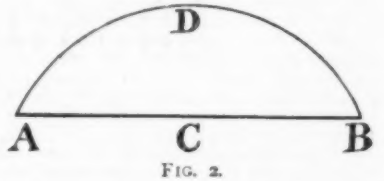

FIG. 2.

Further, the potential energy that a + unit gains when brought from B to A by the route BCA (Fig. 2) must be the same as that gained along any other path, such as BDA. For, if not, let more energy be gained along path BDA than along BCA. Bring the + unit along BDA, and let it return along ACB. Then, since the energy gained along BDA is more than is lost along ACB, a surplus of energy will remain at B; and by continually repeating this cycle,

an infinite store of energy might be collected, without doing, on the whole, any work; which is impossible.

Definition.—If a surface be drawn such that the work done in bringing a + unit of electricity from an infinite distance to all points on it is the same, that surface is called an *equipotential surface.*

The work done in bringing a + unit from an infinite distance to a point distant r centimetres from a charge of $+q$ units

$$= \frac{q}{r} - \frac{q}{\infty} = \frac{q}{r}.$$

Since this expression will be constant for all points distant r cmm. from the charge, the equipotential surfaces surrounding electricity condensed at a point will be spheres concentric with that point.

It may be left as an easy exercise for the student to prove that there will be no gain or loss of energy as a + unit is moved from one point of an equipotential surface to another; and consequently that no force parallel to the surface will act upon it while it remains on the surface. As a consequence, the resultant force on a + unit of electricity will always act normally to the equipotential surface on which it is placed.

Electrified Sphere.—If a conducting sphere be charged with electricity, then the sphere itself must be an equipotential surface. Consequently the force acting on a + unit must everywhere be normal to the surface, and if this force is produced by lines of force, the lines of force due to a charged sphere must radiate from the centre of the sphere. Hence the field at any external point will be the same as if the total charge were concentrated at the centre of the sphere.

Let q = the charge on the sphere, r = its radius. Then potential of any point on the spherical surface

$$= \frac{q}{r}.$$

Let c = the quantity of electricity necessary to increase the potential of the sphere by unity. Then

$$\frac{q+c}{r} = \frac{q}{r} + 1;$$

$$\therefore \frac{c}{r} = 1.$$

$$c = r.$$

The quantity (c) is called the capacity of the sphere.

Two Concentric Conducting Spheres.—If the inner conducting sphere is charged with $+q$ units, and the outer is earthed, since all the lines of force beginning on the inner sphere must end on the outer, there will be $-q$ units on the outer sphere.

The difference of potential between the inner and outer sphere

$$= \frac{q}{r_1} - \frac{q}{r_2},$$

where r_1 and r_2 = the radii of inner and outer spheres respectively. Let the above potential be V.

Then if c = the quantity of electricity necessary to raise the difference of potential between the two by unity

$$\frac{q+c}{r_1} - \frac{q+c}{r_2} = V + 1;$$

$$\therefore c\left(\frac{1}{r_1} - \frac{1}{r_2}\right) = 1,$$

$$c = \frac{r_1 r_2}{r_1 - r_2}.$$

Force inside a Closed Charged Conducting Surface.—Since the surface must be equipotential, no lines of force can start from one point of the surface and end on another. Consequently, if there are any lines of force inside the surface, they must spring from electricity on some body or bodies inside the surface. Hence within a charged conducting surface containing no charged bodies, there must be no force.

Force due to a Charged Infinite Plane.—In this case it will be seen that the repulsive action of lines of force perpendicular to their direction will cause the lines to proceed from the surface normally. Consequently the number of lines of force passing through an area of 1 sq. cm., drawn parallel to the surface, will be the same for all distances from the surface. Hence the force on a + unit will be the same whatever its distance from the surface may be. If σ = the surface density of electricity on the surface, then from each sq. cm. of surface, $4\pi\sigma$ lines of force will proceed. Half of these will proceed from either side of the surface; therefore the number of lines falling on an area of 1 sq. cm., drawn parallel to the surface, will be $2\pi\sigma$. This gives the magnitude of the force at any point, due to a surface density of electricity = σ distributed on an infinite plane surface.

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,
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STAGE 2.

Algebra.

Ex. 43 (*February*).

Let x = selling price in shillings,
then $x - 8$ = gain on 8 shillings,
and $\frac{x-8}{8}$ = gain on 1 shilling.

therefore $20 \times 100\left(\frac{x-8}{8}\right)$ = gain on £100.

$\therefore$ by question, $2000\left(\frac{x-8}{8}\right) = 10x$,

from which $x = 8\frac{1}{3}$ shillings.
(See *Magister*, 'Query Column.')

44. Simplify $\dfrac{\left(\frac{1}{\sqrt{3}} + \frac{1}{\sqrt{5}}\right)(\sqrt{5} - \sqrt{3})}{(\sqrt{5} + \sqrt{3})^2 - (\sqrt{5} - \sqrt{3})^2}$. Ans. $\cdot 0\dot{3}$.

45. If $x = \frac{1}{2}\left\{\sqrt{\frac{a}{b}} - \sqrt{\frac{b}{a}}\right\}$, find the value of

$$\frac{2a\sqrt{1+x^2}}{x + \sqrt{1+x^2}}.$$ Ans. $a + b$.

46. Simplify the expressions:—

(i) $$\left\{\frac{(a^p - q)^q \times (a^q - r)^{r-p}}{(a^r - q)^{r-q}}\right\}^{\frac{1}{r}} \times \{(a^z)^{r^2} + q^2\}^{\frac{1}{r}}$$

Ans. $a^p + 3^q$.

47. Solve the equations:—

1. $\sqrt{x} + \sqrt{a} - \sqrt{ax + x^2} = \sqrt{a}$.
2. $\dfrac{x-1}{x+2} + \dfrac{1}{x} = 4\dfrac{7}{11}$.
3. $\begin{cases} x^2 - 5xy = 14. \\ xy - 5y^2 = 2. \end{cases}$

Ans. $x = \frac{9^4}{16}$; $x = \frac{1}{5}$, or $-2\frac{3}{4}$; $x = \pm 1$, $y = \pm 7$.

48. A locomotive engine without a train can go 24 miles an hour, and its speed is diminished by a quantity which varies as the square root of the number of waggons attached. With four waggons its speed is 20 miles an hour. Find the greatest number of waggons which the engine can move. Ans. 144.

49. A courier passing through a certain place (P) travels at the rate of 5 miles in 2 hours. Four hours afterwards another passes through the same place, travelling the same way, at the rate of 7 miles in 2 hours. How far from the place (P) is the first overtaken by the second? Ans. 35 miles.

Trigonometry.

57. Define a logarithm, and the base of a system of logarithms.

Express 2401 as a power of 7, 243 as a power of 3, 27 as a power of $\sqrt{3}$, 144 as a power of $2\sqrt{3}$, 625 as a power of $\sqrt{5}$, 100,000 as a power of 10. Now from your definition of a logarithm, determine $\log_7 2401$, $\log_3 243$, $\log_{\sqrt{3}} 27$, $\log_{2\sqrt{3}} 144$, $\log_{\sqrt{5}} 625$, and $\log_{10} 100{,}000$.

Ans. 7^4; 3^5; $(\sqrt{3})^6$; $(2\sqrt{3})^4$; $(\sqrt{5})^8$; 10^5; 3; 5; 6; 4; 9; 5.

58. Having given the logarithm of a number to a certain base, how do you find the logarithm of the number to another base?

Given $\log_{10} 2 = \cdot 30103$, calculate $\log_2 10$ to four places of decimals.

Calculate the value of $\frac{3}{4} \div 2^{\frac{7}{19}}$, having given $\log 2 = \cdot 30103$, $\log 1\cdot 00113 = \cdot 0004905$, $\log 3 = \cdot 4771213$. Ans. 3·3219; 1·00113.

59. Having given $\sin 65° 30' = \cdot 91$, $\tan 31° 48' = \cdot 62$, and $\cos 76° 42' = \cdot 23$, find the values of $\cos 25° 30'$, $\cos 205° 30'$, $\sin 294° 30'$, $\operatorname{cotan} 121° 48'$, $\tan 238° 12'$, $\sin 193° 18'$, $\sin 283° 18'$.

Ans. ·91; −·91; −·91; −·62; 1·613; −·23; −4·358.

60. A tower, 50 feet high, stands on the edge of a cliff. From a point in the horizontal plane through the foot of the cliff, the angular elevations of the top and bottom of the tower are observed to be α and β, where $\tan \alpha = 1{\cdot}26$, and $\tan \beta = 1{\cdot}185$. Find the height of the cliff. Ans. 700 feet.

61. Given $\log 2 = {\cdot}30103$, what is the value of $\log \frac{1}{2}$? Although $\sin 30° = \frac{1}{2}$, the logarithm of $\sin 30°$, as found in tables of logarithms, is $9{\cdot}69897$; why is this?

Given L $\tan 38° 16' 10'' = 9{\cdot}8970147$, and L $\tan 38° 16' 20'' = 9{\cdot}8970580$, find the angle whose logarithmic tangent is $9{\cdot}8970365$. Ans. $38° 16' 15''$.

62. Find the angle A of the triangle ABC, having given that AC = 257 ft., BC = 650 ft., and C = 90°. Find also the length of the line AD, which meets BC in D, so that the angle ADC is 40° 32′. Given $\log 1{\cdot}3 = {\cdot}1139434$, $\log 2 = {\cdot}3010300$, $\log 2{\cdot}57 = {\cdot}4099331$. L $\tan 68° 26' = 10{\cdot}4031224$. L $\tan 68° 25' = 10{\cdot}4027530$. L $\sin 40° 32' = 9{\cdot}8128401$, $\log 3{\cdot}9546 = {\cdot}5971026$, $\log 3{\cdot}9545 = {\cdot}5970916$. Ans. 68° 25′ 36″·9; 395·4513.

63. Given $a = 47\sqrt{3}$, $b = 47\sqrt{2}$, $\cos C = \frac{1}{4}(\sqrt{6} - \sqrt{2})$, find c A, B. Ans. $\frac{47}{2}(\sqrt{6} + \sqrt{2})$; 60°; 45°.

STAGE 3.

Algebra.

52. Six men are to address a public meeting; in how many ways may they take their turns (1) so that the shortest of them may not speak first; (2) so that the shortest always speaks either immediately before or immediately after the tallest? Ans. 600; 240.

53. If the n term of an A.P. be the G.M. between the sum of n terms and twice the common difference, show that the ratio of the first term to the common difference is $1 \pm \sqrt{n}$.

54. If a, b, c be in G.P., and if p be the A.M. between a and b, and q the A.M. between b and c, show that b will be the H.M. between p and q.

55. Determine the factors of $n^2 - 2pn - n - 2p - 2$, and hence show that if the coefficients of the $(p+1)^{th}$ and $(p+3)^{th}$ terms of $(1+x)^n$ are equal, then either $n = -1$, or $p = \frac{n}{2} - 1$.

56. Write down the expansion of $(a+b)^n$, and show that if α, β, γ, etc., be the coefficients taken in order, then $1 + \frac{\alpha}{2} + \frac{\beta}{3} + \frac{\gamma}{4} + \ldots\ldots = \frac{2^{n+1} - 1}{n+1}$.

57. Extract the square root of $1\frac{7}{9} + 2\frac{2}{3} \times \sqrt{\frac{1}{3}}$. Ans. $\frac{2}{3}(\sqrt{3} - 1)$.

58. Sum to infinity the series:—

(i) $\frac{1}{2} + \frac{2}{3} + \frac{3}{8} + \ldots\ldots$

(ii) $1 - \frac{2}{3} + \frac{3}{9} - \frac{4}{27} + \ldots\ldots$

Also find the sum of n terms of the series:—

$$1 + \frac{2}{3} + \frac{3}{3^2} + \frac{4}{3^3}.$$

Ans. 3; $\frac{2}{9}$; $\frac{3^{n+1} - 3 + 2n}{4 \times 3^{n-1}}$.

Trigonometry.

48. The cosines of two of the angles of a triangle are $\frac{1}{4}$ and $\frac{3}{5}$, find the ratio of the sides.

49. Two regular polygons of n and $2n$ sides are described such that the circle inscribed in the first circumscribes the second; also the radius of the circle inscribed in the second is to that of the circle circumscribing the first as $3 + \sqrt{3}$ is to $4\sqrt{2}$. Prove that $n = 6$.

50. The vertical angle of an isosceles triangle is 90°, $2p$ is the perimeter of the triangle, and r the radius of the inscribed circle; show that $p : r = \sqrt{2} + 1 : \sqrt{2} - 1$.

51. Prove that in any triangle $\frac{r_1 - r}{a} + \frac{r_2 - r}{b} = \frac{c}{r_3}$, where r, r_1, r_2, r_3, have the usual meaning.

52. If $h \cos\theta + k \sin\theta = 1$, and $l \cos\theta + m \sin\theta = 1$, prove that $(l-h)^2 + (m-k)^2 = (lh - mk)^2$.

53. Given $x = a \cos A$, $y = b \cos B$, prove that $\frac{x^2}{a^2} - \frac{2xy}{ab} \cos\alpha + \frac{y^2}{b^2} = \sin^2\alpha$, where $A + B = \alpha$.

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(*Continued from p.* 486.)

56. The length of a smooth inclined plane is 20 times its height ($\therefore \sin\theta = \frac{1}{20}$). Find the time it will take a body to describe a distance of 80 ft. Ans. 10 secs.

$f = \frac{32}{20} = \frac{8}{5}$, $S = \frac{1}{2}ft^2$, or $80 = \frac{1}{2} \times \frac{8}{5}t^2$; $\therefore t = 10$.

57. If a body falls from rest down the height of an inclined plane in half the time it would take to slide down its length, the plane being smooth, find the inclination of the plane to the horizon. Ans. 30°.

58. A body weighing 10 lbs. slides down an inclined plane, whose height is 25 feet; it reaches the foot of the plane with a velocity of 30 feet per second; how many foot-pounds of energy have been expended during the motion on friction and other resistances, taking g as 32? Ans. $109\frac{3}{8}$.

59. Find the ratio of the height to the length of a smooth inclined plane, down which when a particle slides the acceleration of its velocity is one-fifth of the acceleration of the velocity of a body falling freely under the action of gravity. If such a particle has a mass of 12 lbs., find its velocity and its kinetic energy acquired in descending along 100 feet of the length of the plane. ($g = 32$.) (1887.) Ans. $\frac{1}{5}$; $16\sqrt{5}$; 240 ft. pds.

60. The height of an inclined plane is 50 ft., the length of the base is 120 ft.; a body is moving down the plane at the rate of 52 ft. a second; find its horizontal and vertical velocities.

Solution.—Length of plane $\sqrt{120^2 + 50^2} = 130$ ft.

Body takes $\frac{130}{52} = 2\frac{1}{2}$ seconds to travel from the top to the bottom of the plane, hence

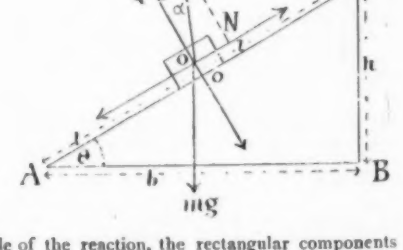
$$\text{vertical velocity} = \frac{50}{2\frac{1}{2}} = 20 \text{ ft. per sec.}$$

$$\text{horizontal velocity} = \frac{120}{2\frac{1}{2}} = 48 \text{ ft. per sec.}$$

61. A smooth inclined plane has a height of 3 ft. for every 10 ft. of its length, what distance would a body descending along it, from a state of rest, describe in $2\frac{1}{2}$ seconds? Ans. 30 ft.

($f = \frac{3}{10}g$; $\therefore s = \frac{1}{2} \times \frac{3}{10}g \times \frac{25}{4}$ gives $s = 30$).

Motion on a rough inclined plane.—When the plane is rough, the reaction between the surfaces, as soon as motion begins, is no longer the common perpendicular, but is inclined to the perpendicular OR, at an angle equal to the angle of repose for the materials in contact; that is, the angle R′OR is equal to α, where α is the angle of friction for the surfaces in contact. If OM denote the



magnitude of the reaction, the rectangular components are represented by ON and OQ; of these only ON can affect the motion; if μ denote the coefficient of friction between the body and the plane (b and l the base and length of the plane respectively), there is an additional force of friction equal to $\frac{M\mu b}{l}$ acting along the plane AC,

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in a direction opposite to the motion, hence the resultant force down the plane will be $Mg\frac{h}{l} - Mg\mu\frac{b}{l}$; $\therefore f$ is found from the equation—

$$Mg\frac{h}{l} - Mg\frac{\mu b}{l} = Mf.$$

$$\therefore f = \frac{g(h - \mu b)}{l}. \quad (1)$$

Note in eq. (1), when $h = \mu b$, then the body is either at rest or moving uniformly, or, in other words, there is no acceleration; $\therefore \mu = \frac{h}{b} = \tan\theta$, where θ is the inclination of the plane to the horizon; when μb is greater than h, the acceleration is negative, or the motion is uniformly retarded. When the body is moving up the plane, gravity and friction will both retard the motion.

Adopting the notation of Trigonometry,

$$\frac{h}{l} = \sin\theta, \quad \frac{b}{l} = \cos\theta.$$

Substituting these values in eq. (1), we obtain :—

$$f = (\sin\theta - \mu\cos\theta)g; \quad (2)$$

or eq. (2) can be obtained directly as follows :—

Resultant moving force down the plane $= Mg\sin\theta - \mu R$.

Resultant moving force perpendicular to plane $= R - Mg\cos\theta$.

Now there cannot be motion in a direction perpendicular to the plane, therefore the acceleration and the total force in that direction is zero.

$$\therefore R - Mg\cos\theta = 0, \text{ or } R = Mg\cos\theta.$$

$$\therefore f = \frac{\text{moving force}}{\text{mass moved}} = \frac{Mg\sin\theta - \mu R}{M}$$

$$= (\sin\theta - \mu\cos\theta)g.$$

62. A particle slides down a rough inclined place, find the acceleration of its velocity.

Under what circumstances would the velocity be retarded?

The angle of friction between a particle and a plane is 30°, and the angle of inclination is 15°; if the particle begins to slide down with a velocity of 100 feet a second, how far will it slide before coming to rest? (1896.)

Solution.—In the eq.—

$$f = g(\sin\theta - \mu\cos\theta).$$

$$\mu = \tan 30° = \frac{1}{\sqrt{3}}.$$

$$\sin\theta = \sin 15° = \frac{\sqrt{3}-1}{2\sqrt{2}}.$$

$$\cos\theta = \cos 15° = \frac{\sqrt{3}+1}{2\sqrt{2}}.$$

Substituting these values we obtain—

$$f = 32\left(\frac{\sqrt{3}-1}{2\sqrt{2}} - \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}+1}{2\sqrt{2}}\right) = \frac{32(1-\sqrt{3})}{\sqrt{6}}.$$

As $\sqrt{3}$ is greater than unity, the value of f is negative, or the particle is retarded by an amount

$$= \frac{32\sqrt{6} - 32\sqrt{18}}{6} = 9{\cdot}5 \text{ ft. per sec. per sec.}$$

From the equation, $v^2 = V^2 - 2fs$, when the particle is brought to rest, $v = 0$; $\therefore V^2 = 2fs$;

hence $100^2 = 2 \times 9{\cdot}5 \times S$,

$$\therefore S = \frac{100 \times 100}{2 \times 9{\cdot}5} = \frac{50 \times 100}{9{\cdot}5} = \underline{526{\cdot}3 \text{ ft.}}$$

63. The inclination of the plane is 30°; and the coefficient of friction is 0·5; if one body falls freely through a given distance, and another body slides down the plane along an equal distance, show that the time of the first body's motion will be very nearly equal to one-fourth part of the time of the second body's motion. ($\sqrt{3} = 1{\cdot}73205$.) (1894.)

Hint: $\frac{t}{t_1} = \frac{\sqrt{f}}{\sqrt{g}} = \frac{\sqrt{h - \mu b}}{\sqrt{l} \times g} = \frac{\sqrt{(2-\sqrt{3})}}{2}$, etc.

64. The height of a plane is four-fifths its length. A body weighing 100 lbs. is placed on the plane; if the coefficient of friction between the body and the plane be 0·1, find the acceleration, the velocity acquired, and the time taken to slide down 100 ft. length of the plane. ($g = 32$.)

Solution.—

$$f = 32\left(\frac{4}{5} - \frac{1}{10} \times \frac{3}{5}\right) = \frac{32 \times 37}{50} = \frac{592}{25};$$

from $v^2 = 2fs = 2 \times \frac{592}{25} \times 100$; $\therefore v = 8\sqrt{74} = 68{\cdot}8$ ft. per sec.;

from $s = \frac{1}{2}ft^2$, or $100 = \frac{1}{2} \times \frac{592}{25} \times t^2$, we get $t = 24{\cdot}3$ sec.

65. (*a*) If a particle slides down a rough inclined plane, find an expression for the acceleration of its velocity.

(*b*) If the inclination of the plane is 30°, and the acceleration is at the rate of 12 ft. a second in each second, find the coefficient of friction. ($g = 32$.) (1892.) Ans. $\frac{\sqrt{3}}{12}$.

Solution.—Let μ denote the coefficient of friction, as in equation (2), then in that eq. $\sin\theta = \sin 30° = \frac{1}{2}$.

$$\cos\theta = \cos 30° = \frac{\sqrt{3}}{2}; \quad \therefore f = g(\sin\theta - \mu\cos 30°)$$

$$= 32\left(\frac{1}{2} - \frac{\mu\sqrt{3}}{2}\right),$$

from which μ is easily found to be $\frac{\sqrt{3}}{12}$.

66. A body weighing 200 lbs. rests on a plane, the length of the plane being three times its height, the coefficient of friction between the body and the plane is 0·2; find the velocity acquired in sliding down the plane a distance of 200 ft., and the time required.

Ans. 43 ; 9·3.

67. The slope of a plane is 45°; find the time in which a body would slide from rest down 100 ft. of its length :—(*a*) if the plane were smooth; (*b*) if it were rough, and the angle of friction 15°. (1883.)

(*a*) $f = g\sin\theta = \frac{32}{\sqrt{2}}$; also $100 = \frac{1}{2}ft^2$;

$$\therefore t^2 = \frac{100\sqrt{2}}{16}; \quad \therefore t = 2{\cdot}97.$$

(*b*) $f = (\sin\theta - \mu\cos\theta)g$; also $100 = \frac{1}{2}ft^2$ gives $t = 3{\cdot}47$ seconds.

68. A body is projected down a rough inclined plane, whose limiting angle of resistance is a, from a point A, with the given velocity v, due to a height h. If AK he drawn vertical and equal to h, and if KL be a line sloping downwards at the angle a, prove that the velocity of the body at any point B is that due to the vertical distance of B below the line KL. Hence if KL meets the inclined plane in C, the body comes to rest at C.

If the body were projected *up* the plane, find where it comes to rest.

(To be continued.)

THE 'GRAPHIC' OFFICE.

Another Volume of **The Golden Penny** has just been completed. Twelve months ago we had occasion to praise in the highest terms this excellent and popular production. We have again carefully examined the pages of the issues which have appeared during the past six months, and have no hesitation in saying that the paper is the most interesting and best produced weekly extant. It contains a large number of short stories by the best writers. Amongst those who have contributed are Morley Roberts, A. J. Dawson, G. B. Burgin, W. H. Wilkins, John Foster Fraser, Francis Gribble, and many others. In addition the volume contains a great store of information on many subjects, including a most useful set of articles on 'Berths for our Boys.' Another series of articles has been given dealing with the Football of our Public Schools, and famous footballers and cricketers have a regular place. The illustrations to the volume will be found of exceptional merit, and the work of the Puzzle Editor also deserves special commendation.

Our Science Section next month will contain special notices of recently issued Science Text-Books.

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SCIENCE NOTES.

FLOWERS AND THE COLOUR SENSE OF INSECTS.—Some interesting experiments on the colour sense of insects by Professor Plateau of Ghent are detailed in the *Bulletin de l'Académie Royale de Belgique*. They tend to disprove the usually accepted view that the brightly coloured petals of flowers are the chief means of attracting insects. Professor Plateau carefully removed the brightly coloured corollas from the flowers of *Lobelia erinus*, *Œnothera biennis*, *Ipomœa purpurea*, *Delphinium ajacis*, *Digitalis purpurea*, and *Antirrhinum majus*, and the blue barren florets from the capitula of *Centaurea cyanus*. Except in the case of *Antirrhinum majus*, the mutilated flowers were seen to be visited by various kinds of insects—bees, bumble bees, flies of the *Syrphidæ* family, and an occasional butterfly. No preference was apparently shown by these insects for flowers of the same kind that were left intact. They not only sucked honey from the mutilated flowers, but they often circled round them without alighting. In the case of the snapdragon, however, bumble bees hovered round the mutilated flowers, but subsequently left them for those whose corolla had not been removed, the peculiar mode in which they have to enter the corolla apparently making the absence of that organ puzzling to them. Professor Plateau thinks that insects are attracted to flowers more powerfully through their sense of smell than through their colour sense.

***

THE NEW PROCESS OF PHOTOGRAPHY IN COLOURS.—A further advance in the production of coloured photographs has been made by M. Villedieu Chaisagne, who has developed a process originally suggested by Dr. Adrian Dansac. An ordinary negative is first taken, then immersed in a special solution, the nature of which is at present a secret. It is then developed and fixed in the usual way. The finished negatives and prints look just like other negatives and prints, but when they are treated with blue, green, and red solutions respectively, they take up the appropriate colours in the appropriate parts, the three colours blending to give all varieties of hue. Specimens so prepared can be seen at the rooms of the Society of Arts. Though the composition of the four solutions has not as yet been disclosed, it may be conjectured that the first one acts as a mordant, enabling the film to exert a selective action upon the colours employed. Apparently the coloured solutions contain aniline dyes, and are of various degrees of acidity and alkalinity. The prints are immersed first in the blue, then in the green, and lastly in the red solution, the reactions that occur causing the production of the various intermediate tints.

***

THE DRUNKENNESS OF BUMBLE BEES.—Mr. J. Ll. Williams contributes to the *Journal of Botany* an interesting note on the drunkenness of bumble bees, due to the honey of flowers belonging to the *Compositæ* and *Dipsacaceæ*. The crowded flowers of the heads of *Carduus nutans*, *Carduus lanceolatus*, and *Scabiosa succisa* contain honey which, when eaten, causes the bees to roll on their backs, strike their legs wildly in the air, and show signs of general helplessness. The greatest sufferer was the neuter of *Bombus lapidarius*. As a rule, the bees not only quickly recovered from the effects of the honey, but were eager for a fresh feast. When, however, a bee was shut up in a vasculum with a quantity of *Centaurea scabiosa* it became sated, tried to get as far as possible from the flowers, and hurried away as soon as it was released.

***

SCIENCE AND THE INTERNATIONAL EXHIBITION AT BRUSSELS.—The Science Section of the International Exhibition which will be held at Brussels this year will comprise seven classes—Mathematics and Astronomy, Physics, Chemistry, Geology and Geography, Biology, Anthropology, and Bibliography. Exhibitors are offered space free of charge, and reduction of rates for the transport of the exhibits. In connection with this exhibition the Belgian Government offers prizes amounting in all to 20,000 francs for the best solutions of a number of scientific problems, a list of which will be furnished by M. van Overloop, 17, Rue de la Presse, Bruxelles. Objects or memoirs designed for competition or exhibition must be sent in before the middle of April.

***

THE GROWING IMPORTANCE OF BEET SUGAR.—It was in 1747 that Andreas Marggraf discovered that the sugars in beetroots, carrots, and other fleshy roots grown in temperate countries were chemically identical with one another and the sugar of the sugar cane. The first beet sugar factory was erected in 1801 near Breslau in Silesia, and, encouraged by artificial political protection which closed foreign markets to free British sugar, beet sugar factories sprang up in various parts of France and Germany. The emancipation of the slaves in the West Indies checked the supply of cane sugar for a time; the abolition of differential duties in favour of the Colonies, and the placing of sugar on the free list, further caused them to lose ground. Germany and other sugar-producing countries of Europe offer bounties on production or export, but tax home consumption. While in 1845 Great Britain imported only 4,000 cwt. of beet sugar, in 1895 twenty-three million hundredweights were imported. British sugar-cane growing colonies have now to face a very serious problem.

***

A NEW BIRD OF PARADISE.—A fine new bird of paradise was discovered by Sir William Macgregor on the heights of Mount Scratchley, in British New Guinea, and has been exhibited at the British Ornithologists' Club.

***

THE HOMOLOGY OF THE POLLEN AND OVULE.—M. Molliard has recently conducted an interesting series of observations on abnormal structures of *Torilis Anthriscus* and *Sinapis arvensis*, and is of opinion that the anther corresponds homologically to a simple leaf, the leaf of which is folded over on each side of the median vein. Each half gives rise to a mass of pollen, but the two halves are not of equal value, for while one contains the median fibro-vascular bundle, the other is only an emergence of the first, and contains only very small vascular bundles. After comparing a number of cases of transformation of stamens into carpels in *Sedum*, *Petunia*, *Narcissus*, etc., he concludes that the entire pollen mass of an anther is the homologue of a row of ovules, the integument of the ovule corresponding to the invaginated epiderm. The degree of coalescence that exists between the nucellus and the integument varies greatly in different classes of plants. The naked ovule of the *Santalaceæ* and *Balanophoraceæ* corresponds altogether to a pollen mass. The number of rows of ovules in a carpel varies in proportion to the number of pollen masses in each anther lobe. The non-marginal placentation of *Papaver* and *Nymphæa* may be compared to the distribution of the pollen masses over the whole upper surface of the staminal leaf in *Viscum*.

REPLIES TO SCIENCE QUERIES.

John Kelly, 9, York Place, Glamorgan.—Two small straight magnets, of magnetic moments M, M′, are placed in the same straight line, with similar poles facing each other. Show that if their dimensions are negligible in comparison with r, the distance between their centres, the force tending to separate them is $6MM'r^{-4}$.

Answer.

Let m = pole strength of magnet with moment M.
m' = ,, ,, ,, M′.
$2l$ = length ,, ,, M.
$2l'$ = ,, ,, ,, M′.
so that $M = 2ml$.
$M' = 2m'l'$.

Let d = the distance between the near pole of the magnet (moment M′) from the centre of the other,
so that $d = r - l'$.

Then repulsive force on magnet of moment M′

$$= m'm\left\{\frac{1}{(d-l)^2} - \frac{1}{(d+l)^2}\right\}$$

$$= \frac{4mm'dl}{(d^2-l^2)^2}$$

$$= \frac{2Mm'}{d^3},$$

neglecting l^2 in comparison with d^2.

The attractive force on the other pole will be found by substituting $d + 2l'$ for d in the above expression, and therefore equals

$$\frac{2Mm'}{(d+2l')^3} = \frac{2Mm'}{d^3\left(1+\frac{2l'}{d}\right)^3}$$

$$= \frac{2Mm'}{d^3}\left\{1 - \frac{6l'}{d} + \ldots\ldots\right.$$

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by the Binomial Theorem. Therefore total force = repulsive force — attractive force

$$= \frac{2Mm'}{d^3} - \frac{2Mm'}{d^3}\left\{1 - \frac{6l'}{d} + \ldots\ldots\right\}$$

$$= \frac{12Mm'l'}{d^4}$$

$$= \frac{6M \times 2m'l'}{(r - l')^4}$$

$$= \frac{6MM'}{r^4},$$

neglecting l' in comparison with r.

'*Larden.*'—What will happen if—

(i.) One point only in a battery circuit,

(ii.) Two points simultaneously,

be put to earth respectively?

Discuss whether or no two points could be found which might be put to earth simultaneously without the current being affected.

Give a graphical (or geometrical) representation of condition in circuit, with explanation.

Answer.

Let it be borne in mind that the battery itself forms part of the electric circuit. Then if only one point in the circuit be earthed, the battery must be considered insulated. The point that is earthed will be at the potential of the earth, *i.e.* at zero potential. On the other hand, since the current in the circuit depends not on the *absolute* potential of either of the terminals of the battery, but upon the *difference of potential* between them, which will not be affected by earthing a point in the circuit, the current will be unaffected.

If two points in the circuit are earthed, then the resistance of the part of the circuit between these points will be reduced to zero. Consequently the current will in general be increased.

Let e = total E.M.F. round circuit.

r_1 = internal resistance of battery.

r_2 = resistance between the two earthed points in the circuit.

R = the remaining resistance external to the battery.

Then before the points were earthed the current generated

$$= \frac{E}{r_1 + r_2 + R}.$$

After the two points have been earthed the current

$$= \frac{E}{r_1 + R}.$$

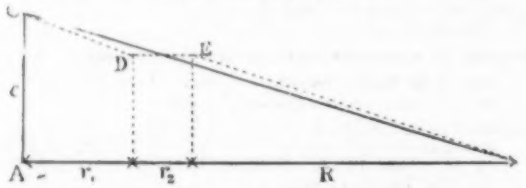
For the current in the two cases to be equal we must have

$$\frac{E}{r_1 + r_2 + R} = \frac{E}{r_1 + R}.$$

The only conditions under which this can be true are—

1. $r_2 = 0$.

2. That $r_1 + R$ is so great in comparison with r_2, that adding the latter will make only a negligible difference in the total resistance round the circuit.



The figure exhibits the conditions graphically. Let length AC represent the total E.M.F. round the circuit, whilst

$$AB = r_1 + r_2 + R,$$

the total resistance round the circuit. Then the current will be represented by the tangent of the angle ABC.

When r_2 is short circuited by having its ends earthed, the fall of potential will be given by the lines CD, DE, EB, remembering that the earthed points must be at the same potential as each other, and therefore DE is parallel to AB. The current round circuit = tan ABE, and for this to be equal to tan ABC, r_2, *i.e.* length DE, = 0, or must be so small in comparison with total length AB as to make no appreciable difference in the angle at B in the two cases.

H.C.P.—See page 528.

A SUMMARY NOTICE OF RECENT SCHOOL PUBLICATIONS.

WE have reason to believe that the columns we devoted last month to the brief notice of recent issues from the educational press and the houses of scholastic publishers, have met with wide-spread approval. This is in itself a matter of much satisfaction, and also an encouragement to the continuance and development of our plan, which will, we trust, be found serviceable in placing our readers *au courant* with all the noteworthy new school-books and other appliances which may be helpful to practical teachers.

During the past month we have received a considerable number of new publications, many of them affording evidence of the extent to which the more modern subjects of Elementary Science and Manual Training are taking root in our Primary Schools.

We proceed to mention, with such comment as may seem necessary, the works received from various publishers.

AMERICAN BOOK COMPANY, NEW YORK.

The Story of the Chosen People, by H. A. Guerber, is one of a series of reading books issued under the general title of 'Eclectic School Readings.' It contains in a neatly bound volume seventy well-written chapters mainly on the history of the Hebrews, beginning with the Creation and ending with the Destruction of Jerusalem. The object consistently kept in view is not to supply distinctive religious teaching, but to state in an objective manner the facts and traditions of Bible history which form the historical basis of the Jewish and Christian religions alike. The work is admirably illustrated by a series of full-page reproductions, mostly from famous paintings, also by two sketch maps and many small cuts.

Immensee, by Theodor Storm, is the title of a tender and graceful romance from one of the best of German story writers. The litt e book is clearly printed in German text, and contains a most complete, well-arranged, and thoroughly reliable vocabulary.

BLACKIE AND SON, LIMITED.

Blackie's Object-Lesson Sheets: Set C. This is another of the well-planned series of pictorial illustrations for object teaching, the earlier sets of which we have previously noticed. It consists of twenty-five eyeleted sheets packed in a strong cardboard box. The subjects include typical animals, plants and trees, and a few of physical phenomena. They are carefully adapted for use in Standard III., particularly where the same publishers' object-lesson books are adopted. We can heartily commend these sheets as aids to the now generally accepted method of object teaching.

The Warwick Shakespeare: Cymbeline, edited by Alfred J. Wyatt, M.A., and **The Tempest,** edited by Frederick S. Boas, M.A. These two additional volumes of this model edition of Shakespeare's plays have been entrusted to remarkably able editors, who seem to be in full sympathy with the ideas which distinguish this edition and which fit it specially for the use of the literary student. The highest authorities have been consulted in the compilation of the notes, brilliant scholarship lights up the introductory essays, and the appendix on prosody in each volume is an important feature.

To previous issues of the Oxford Manuals of English History are now added **King and Baronage,** by W. H. Hutton, M.A., and **The Making of the British Empire** (A.D. 1714–1832), by Arthur Hassall, M.A. These compact volumes may be recommended to students who wish to attain a sound knowledge of the periods with which they deal. They contain sufficient detail for the junior student, and are written so as to bring into prominence the chief characteristics of the epoch and the inevitable relation of cause and effect.

English for Beginners, Lower English, Higher English, by David Campbell, are three judiciously graded text-books. The first begins with the sentence and its construction, which is treated in a very simple and rational manner. The second is adapted for use in intermediate classes, and the third for secondary schools. Each contains numerous exercises and examination questions.

The Warwick Shakespeare is a series of separate plays edited for the use of advanced students in a manner that deserves the highest praise. The editors of the several volumes are men of ripe scholarship, and they all keep well in view the distinctive feature of the series, namely, the paramount importance of the study of Shakespeare as a *literary* study. Some of the introductions we have read may be described as masterly essays in literary criticism, admirably calculated to guide the reader to an enlightened appreciation of the works they introduce. Amongst the latest volumes issued are **As You Like It,** edited by J. L. Smith, M.A.; **Twelfth Night,** by A. D. Innes, M.A.; **Henry**

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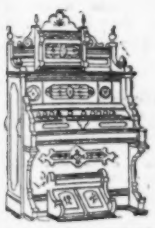

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Matriculation Directory. No. XXI. January, 1897. The latest issue of this serial publication contains, like its predecessors, abundant information on the matriculation of the University of London, and also a complete set of full answers to the questions set at the January examination. As the answers are the work of the experts who form the staff of the University Correspondence College they may be confidently used as models for the student.

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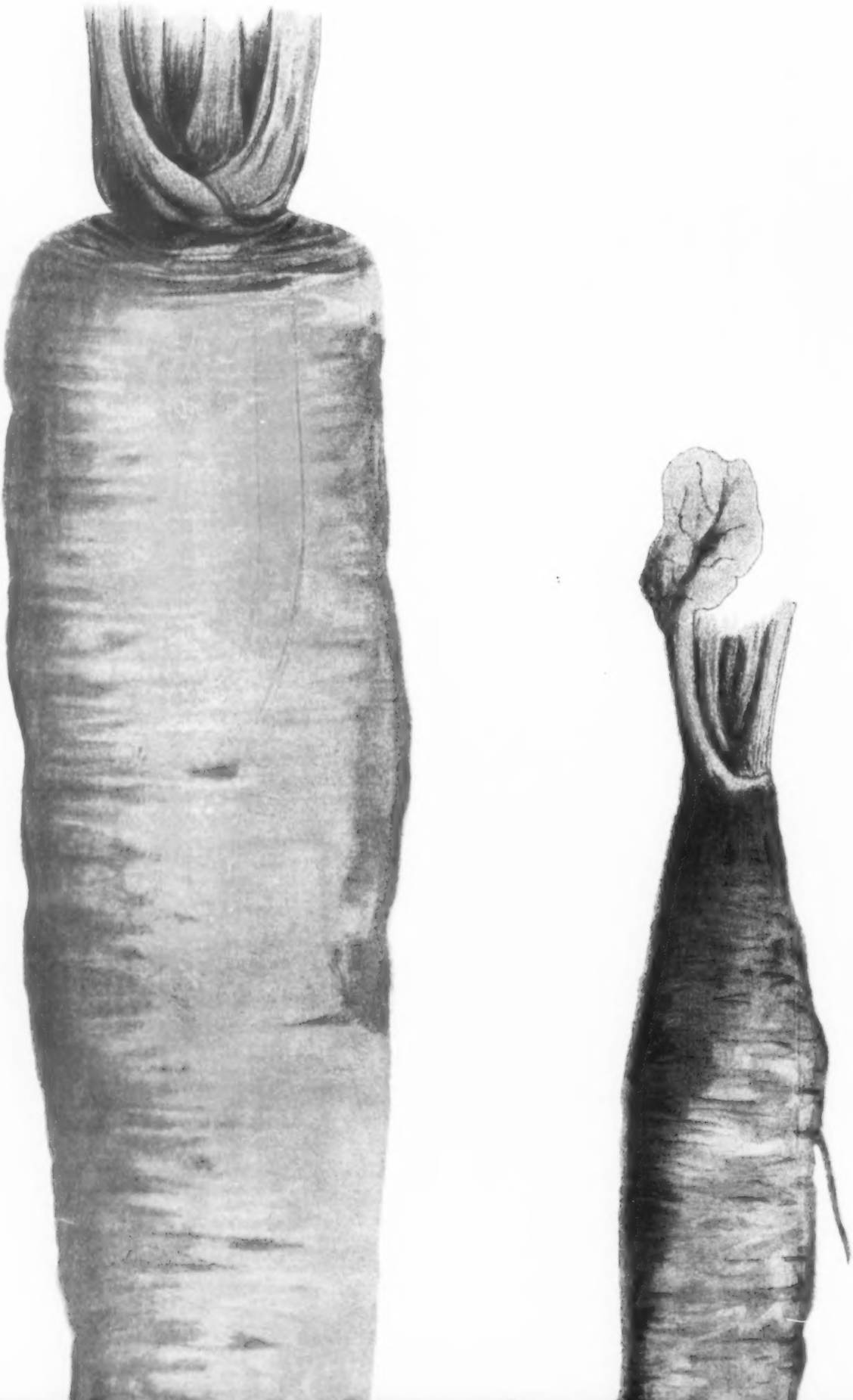

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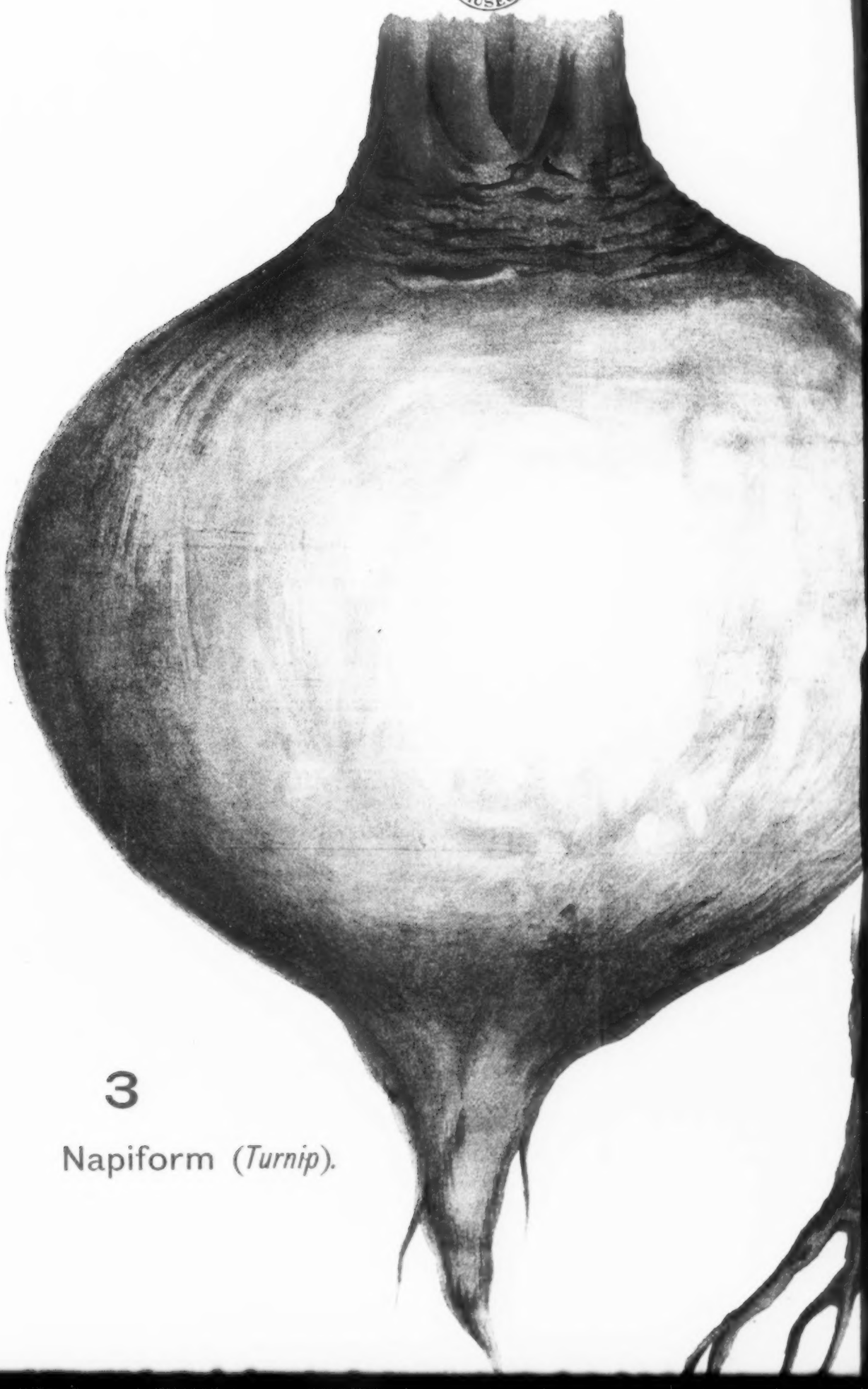

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Napiform (*Turnip*).

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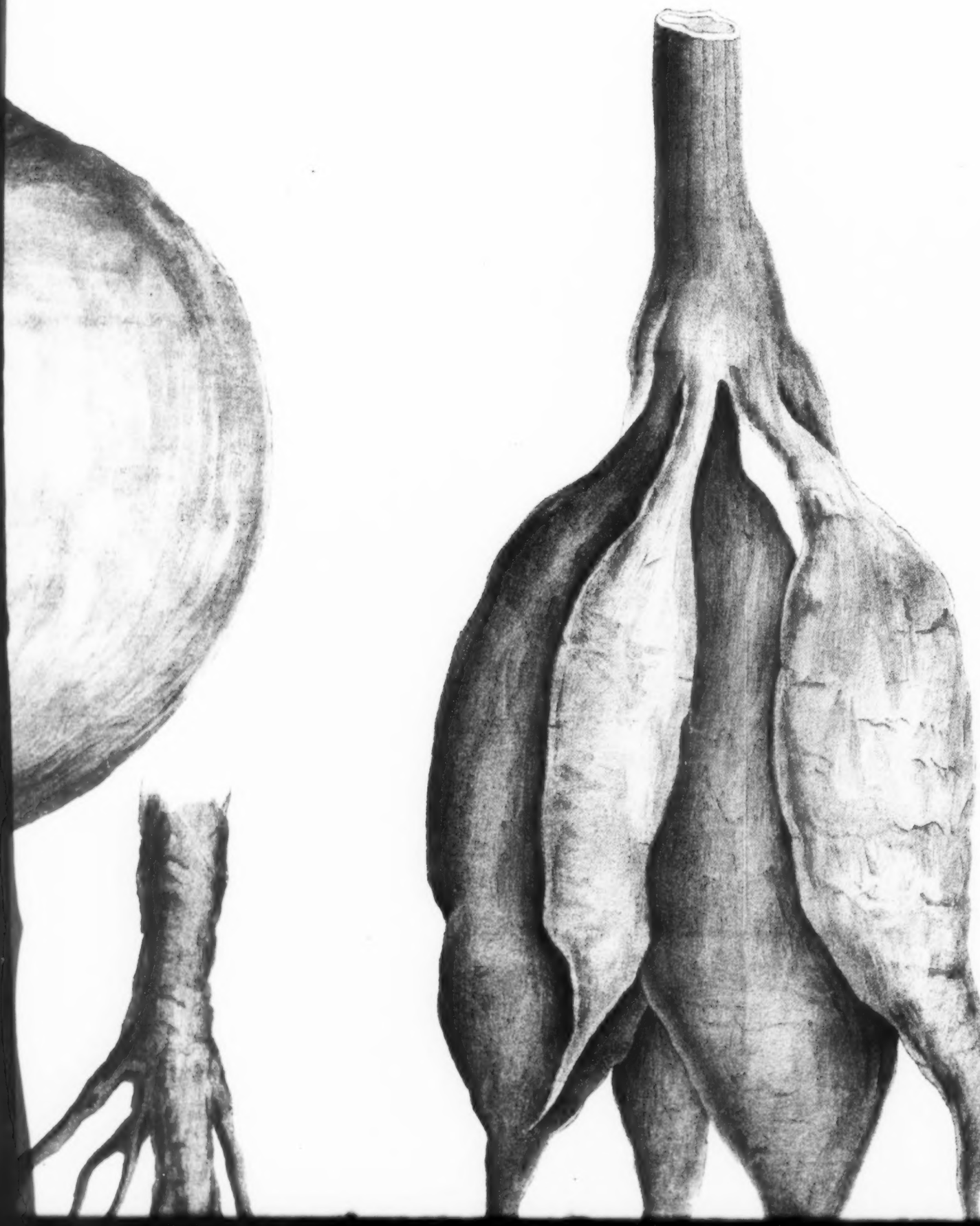

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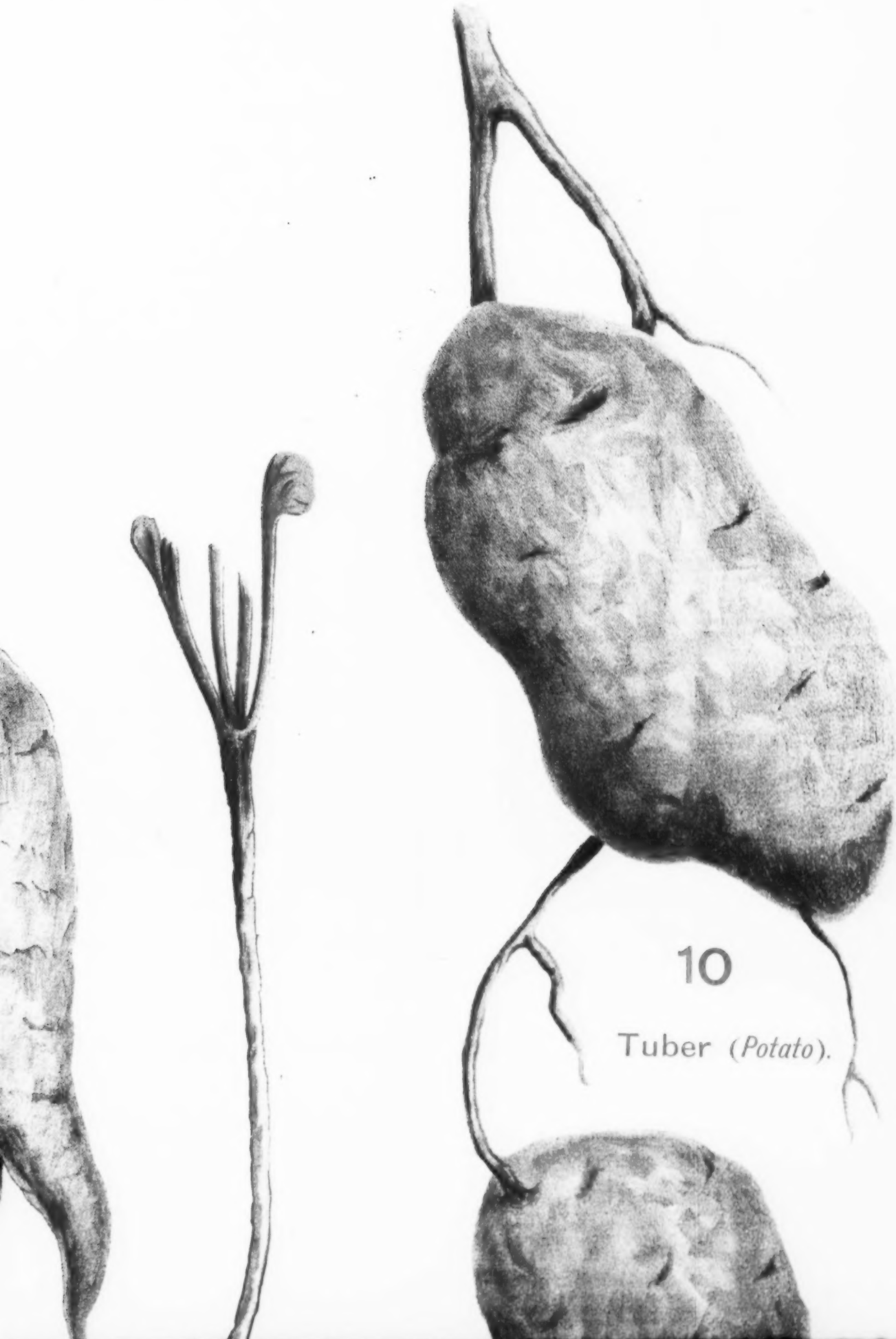


10

Tuber (*Potato*).

1

Conical (*Carrot*).

2

Fusiform (*Radish*).

4

Fibrous (*Grass*).

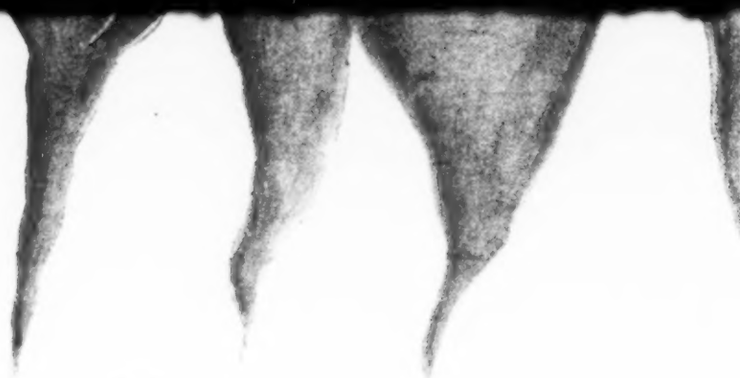
5

Nodulose

ROOTS AND

5

Nodulose (*Spiræa*).



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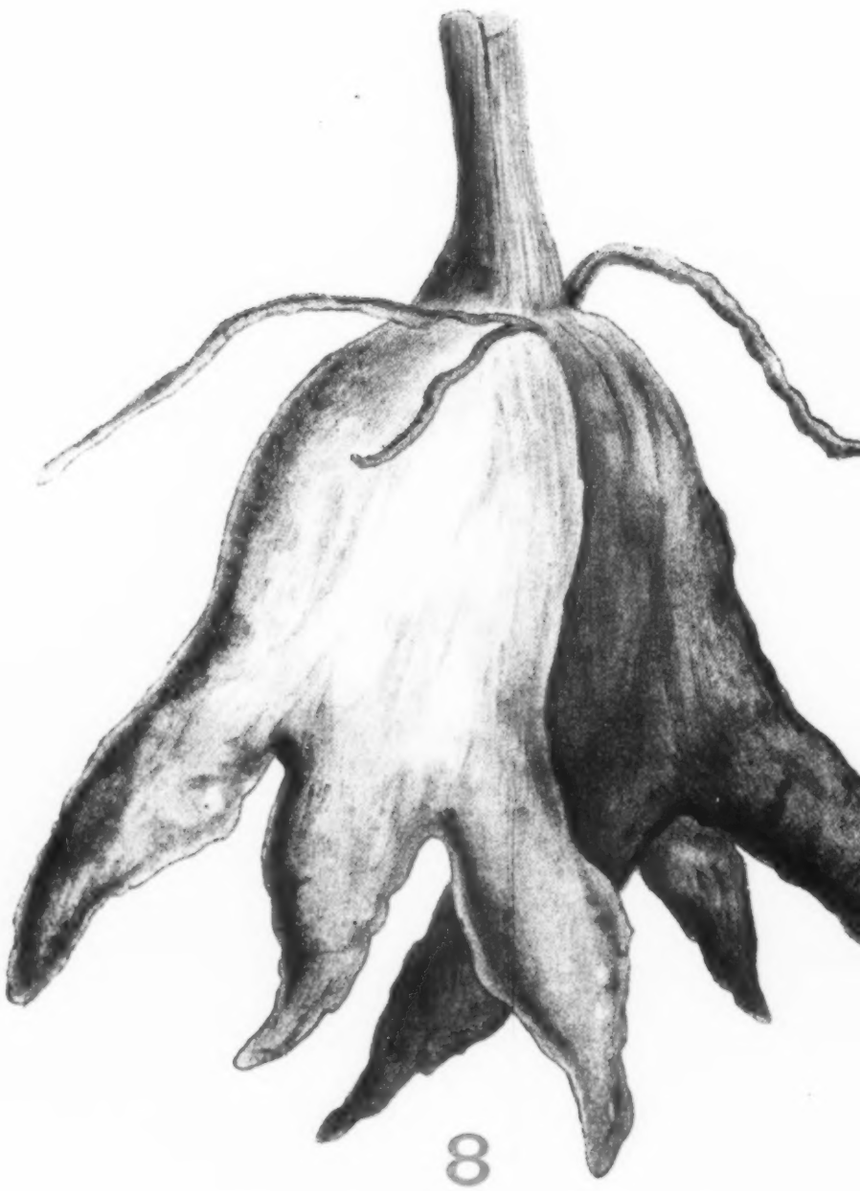
Fasciculate Tuberous (*Dahlia*).



8

Palmate Tuber (*Orchis*).

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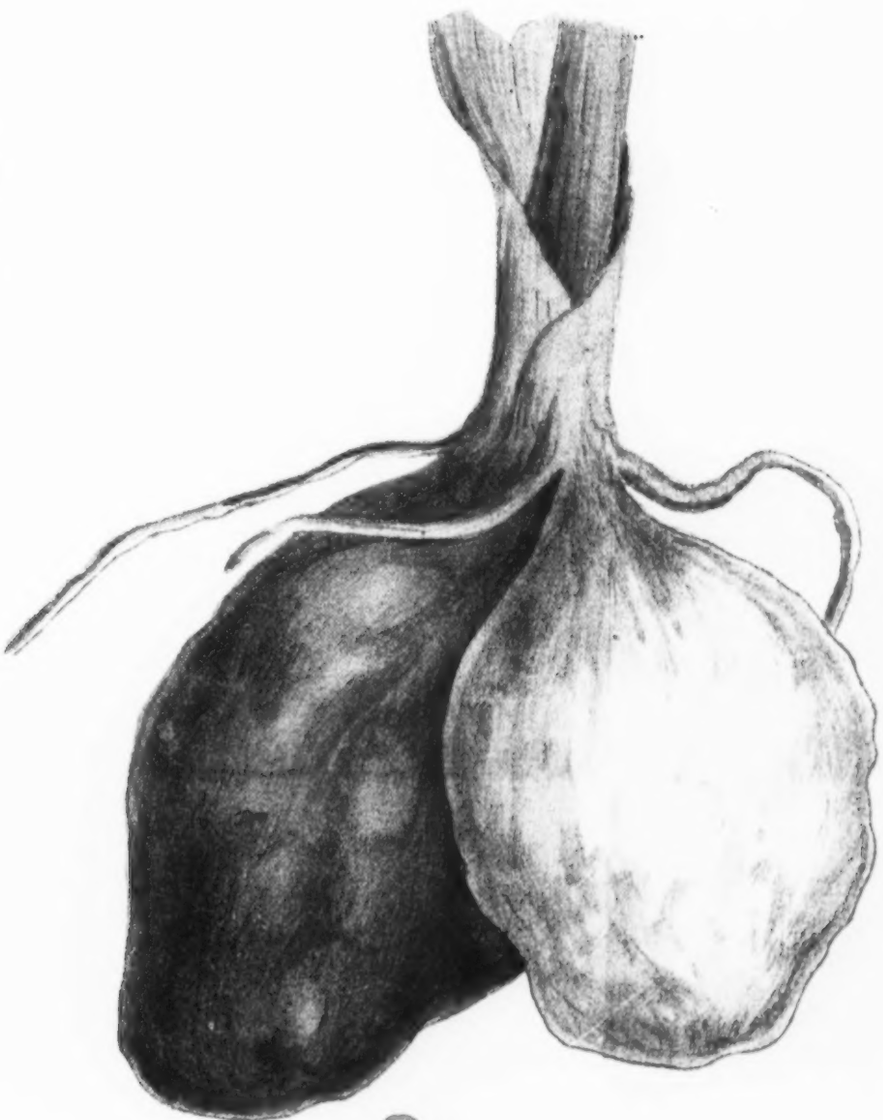
6

Filiform.



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Testiculate Tuber (*Orchis*).

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